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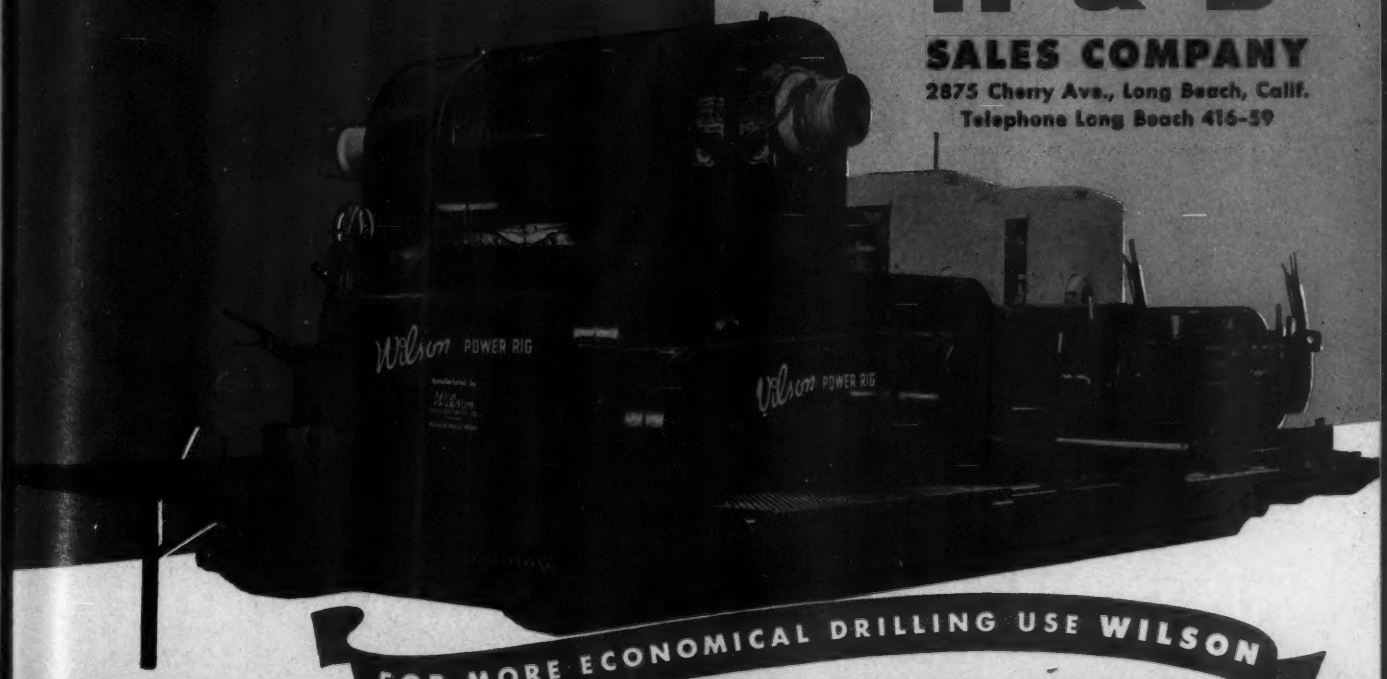

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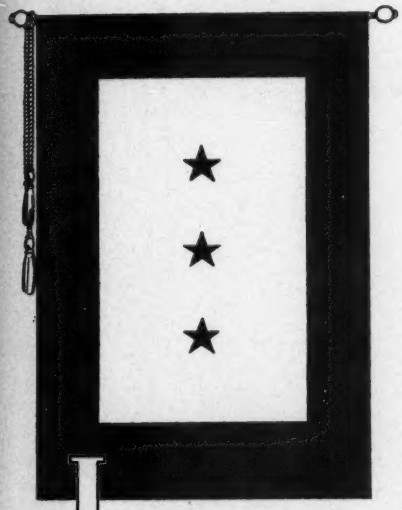

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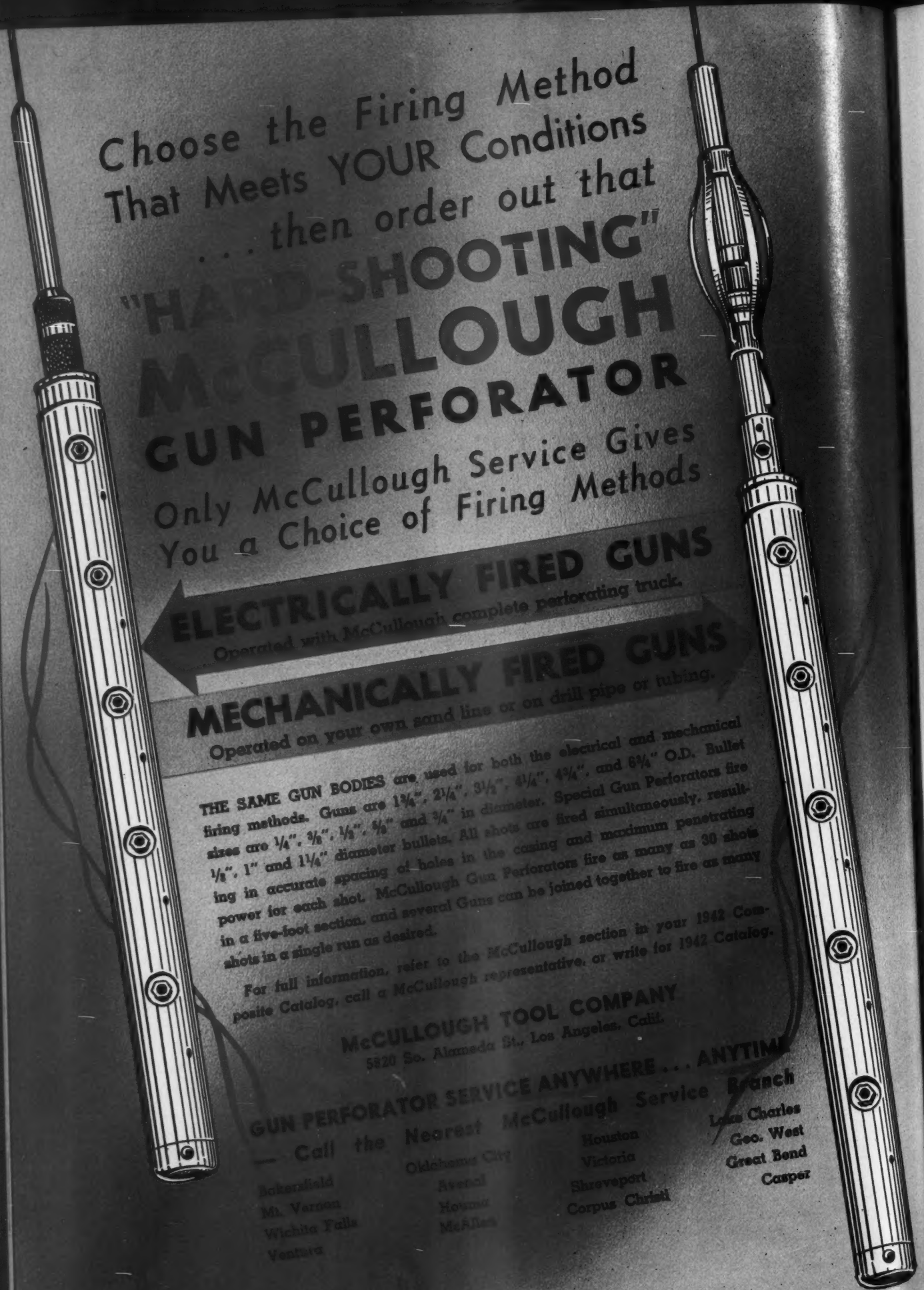

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Oil and Gas Fields of San Joaquin Valley
and Northern California

By Paul J. Howard*
Chief Appraisal Engineer and
Assistant Assessor
Kern County, California

Introduction

The great central valley of California, comprising the San Joaquin Valley and its northern extension, the Sacramento Valley, is bounded on the east by the Sierra Nevadas and the Cascade Range, on the north by the Klamath Mountains, on the west by the Coast Ranges, and on the south by the Transverse Ranges which connect the Sierra Nevadas and the Coast Ranges. These valleys, forming a huge trough, have been marine areas during much of the time following the Jurassic age. During these millions of years, thousands upon thousands of feet of marine sediments have been collecting, together with non-marine deposits during the latter part of the period represented. Sometimes there are alternating marine and fresh water sediments, together with their distinctive fossils. The total thickness of all of these sediments is well in excess of three miles in the south-central portion of the Valley. The remains of microscopic, and larger, organic life has been deposited with the sands and clays and is the source material for the oils of our Valley.

During these millions of years the crust of the earth has been contorted, resulting in uplifts, folding and faulting. Oil and gas have separated from the water due to difference in gravity and have collected in the highest positions to which migration was possible. Thus we have accumulations in the top of wrinkles (anticlines and domes) and in the upper portion of inclined sands (homoclines and monoclines)

Paul J. Howard

where the sands have been sealed by faulting or pinching or lensing out. All of the East Side fields are the result of accumulations of oil on inclined slopes which dip in a westerly direction and most of which are sealed by intersecting faults on the East and Northeast where impervious clays and shales have been moved against the upper edges of the oil sands, thus preventing further migration easterly. Some of the East Side productive areas are the result of old shore lines or lenses of sand pinching out up dip toward the East, or toward the South in the case of the Grapevine field. On the West Side of the Valley faulting plays a far less prominent part in the oil accumulations. Here we have a huge homoclinal structure extending from below Maricopa almost to McKittrick in which oil and gas have migrated to the West as far as possible to where the sands were sealed against the flanks of older formations rising from below. We have huge anticlinal fields extending valleyward from the homoclinal Valley edge fields together with anticlinal accumulations separated entirely from the westerly Valley limits. Also there are anticlinal accumulations in the Miocene rocks which outcrop in the foothills of the Coast Ranges along the Valley edge. All of the new mid-Valley fields are either anticlinal accumulations or shore line deposits along structural noses extending valleyward from the sides of the Valley.

Because of the huge areas of possible oil land which have not yet been explored we have reason to expect the discovery of many new fields in the years to come.

In the following pages, the writer has attempted to present a brief outline of the pertinent data regarding the various oil and gas fields of the San Joaquin Valley and northern California. The data have been gathered during many years of service as Petroleum Engineer with the State Division of Oil and Gas and from the records in the Assessor's office. The production figures have been obtained largely from the Division of Oil and Gas, whose staff has been of great help in preparing this article. Many engineers and geologists have assisted greatly in furnishing data for this report and various issues of "Summary of Operations, California Oil Fields," have been consulted freely during its preparation.

(1) NORTH BELRIDGE OIL FIELD

(Discovered in 1915)

(Temblor Zone Discovered in 1930, Bloemer Sand and Belridge Sand Discovered in 1932)

Location: About 32 miles Northwest of Taft. Township: 27/20, Sec.

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* *Paul J. Howard, in the Kern County Assessor's office, has done the valuation work for the oil fields of that county for 6 years. He graduated "with honors" from the College of Mining, University of California, in 1924, specializing in petroleum engineering. His experience includes eight years as petroleum engineer with the State Division of Oil & Gas in Los Angeles, Long Beach, Taft and Bakersfield, having had charge of both the Long Beach and Bakersfield offices. He is a member of American Institute of Mining and Metallurgical Engineers, American Association of Petroleum Geologists, and of Tau Beta Pi, national engineering honor society.*

THE OIL AND GAS FIELDS OF SAN JOAQUIN VALLEY AND NORTHERN CALIFORNIA

Ref. No.	Fields (Alphabetically arranged)	Oil or Gas	County
1	Belridge-North	Oil	Kern
2	Belridge-South	Oil	Kern
3	Buttonwillow	Gas	Kern
4	Canal	Oil	Kern
5	Canfield Ranch	Oil	Kern
6	Chowchilla	Gas	Madera
7	Coalinga (East-Eocene)	Oil	Fresno
8	Coalinga (Northeast-Eocene)	Oil	Fresno
9	Coalinga Old field—East and West)	Oil	Fresno
10	Cole's Levee (including North and South Areas)	Oil	Kern
11	Devil's Den	Oil	Kern
12	Dudley Ridge	Gas	Kings
13	Edison	Oil	Kern
14	Elk Hills	Oil	Kern
15	Eureka	Gas	Humboldt
16	Fairfield Knolls	Gas	Yolo
17	Fruitvale	Oil	Kern
18	Grapevine	Oil	Kern
19	Greeley	Oil	Kern
20	Helm	Oil	Fresno
21	Jacalitos	Oil	Fresno
22	Kern Front	Oil	Kern
23	Kern River	Oil	Kern
24	Kettleman Hills (Middle Dome)	Oil	Kings
25	Kettleman Hills (North Dome)	Oil	Fresno & Kings
26	Lost Hills	Oil	Kern
27	Marysville Buttes (Sutter Buttes)	Gas	Sutter
28	McDonald Island	Gas	San Joaquin
29	McKittrick-Temblor-Cymric	Oil	Kern
30	Midway-Sunset (incl. Buena Vista Hills)	Oil	Kern
31	Mount Poso	Oil	Kern
32	Mountain View	Oil	Kern
33	Paloma Oil Field	Oil	Kern
34	Paloma Dry Gas Field	Gas	Kern
35	Poso Creek	Oil	Kern
36	Potrero Hills	Gas	Solano
37	Raisin City	Oil	Fresno
38	Rio Bravo	Oil	Kern
39	Rio Vista	Gas	Solano & Sacramento
40	Riverdale	Oil	Fresno
41	Round Mountain	Oil	Kern
42	Semitropic	Gas	Kern
43	Strand	Oil	Kern
44	Ten Section	Oil	Kern
45	Tracy	Gas	San Joaquin
46	Trico	Gas	Kern & Tulare
47	Vernalis	Gas	San Joaquin
48	Wasco	Oil	Kern
49	Wheeler Ridge	Oil	Kern
50	Willows	Gas	Glenn

21, 22, 26, 27, 28, 34, 35, and 36. Township: 27/21, Sec. 1 and 2.

Topography: Flat to low rolling hills.

Type of Oil Accumulation: Anticlinal. N.W.-S.E. Axis.

Geological Horizons Productive: Tulare — Pleistocene, Etchegoin — Pliocene, Santa Margarita (Reef Ridge)-Uppermost Miocene, Temblor-Middle Miocene and Vaqueros-Lower Miocene. (The Vaqueros zones were formerly incorrectly designated Upper and Lower Wagonwheel.)

Thickness of Oil Sands: 30 to 450 feet.

Well Depths: 800 feet to 9000 feet.

Number of Potential Wells, 1941: 129, including shallow wells.

Average Well Size: Temblor 88 bbls. per day average maximum efficient rate. Vaqueros (Bloemer and Belridge Sands) about 84 bbl. per day average maximum efficient rate. Negligible amount of production from shallower wells.

Gravity of Oil: 31° to 55° A.P.I. in Temblor and Vaqueros. Shallow zones: 13.5° to 34° AP.I.

Method of Production: Temblor and deeper zone wells flow. Large commercial supply of gas. Shallow zone wells are pumped. No commercial gas in shallow zones.

Bbls. Oil Produced in 1941: 3,435,293 bbls.

Total Field Production to end of 1941: 42,350,420 bbls.

Total Cumulative Production per acre: 24,320 bbls.

Proved Acreage at End of 1941: About 1740.

Note: Most of Vaqueros production comes from fringe of oil around edge of gas cap.

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(2) SOUTH BELRIDGE OIL FIELD

(Discovered in 1911)

Location: About 25 miles Northwest of Taft. Townships: 28/20, Sec. 24. 28/21, Sec. 19 and 23-34, incl. 29/21, Sec. 2, 3, 4, 10, and 11.

Topography: Almost flat, sagebrush land.

Type of Oil Accumulation: Anticlinal. Axis waving but with general N.W. and S.E. direction. Axis plunges rapidly to S.E. and flattens to N.W.

Geological Horizons Productive: Etchegoin-Pliocene, Contact Zone (Etchegoin-Santa Margarita), and Santa Margarita-Upper Miocene. Upper zone missing in northern part of area.

Thickness of Oil Sands: 2 to 70 feet.

Well Depths: 650 to 3500 feet.

Number of Potential Wells, 1941: 258.

Average Well Size: 10 bbls. per day potential. Cut about 40% water.

Gravity of Oil: 10° to 29° A.P.I. Some commercial gas.

Method of Production: All wells now pumpers, although in early days some wells flowed.

Bbls. Oil Produced in 1941: 765,030.

Total Field Production to end of 1941: 24,582,164 bbls.

Total Cumulative Production per Acre: 14,540 bbls.

Proved Acreage at End of 1941: 1690 acres.

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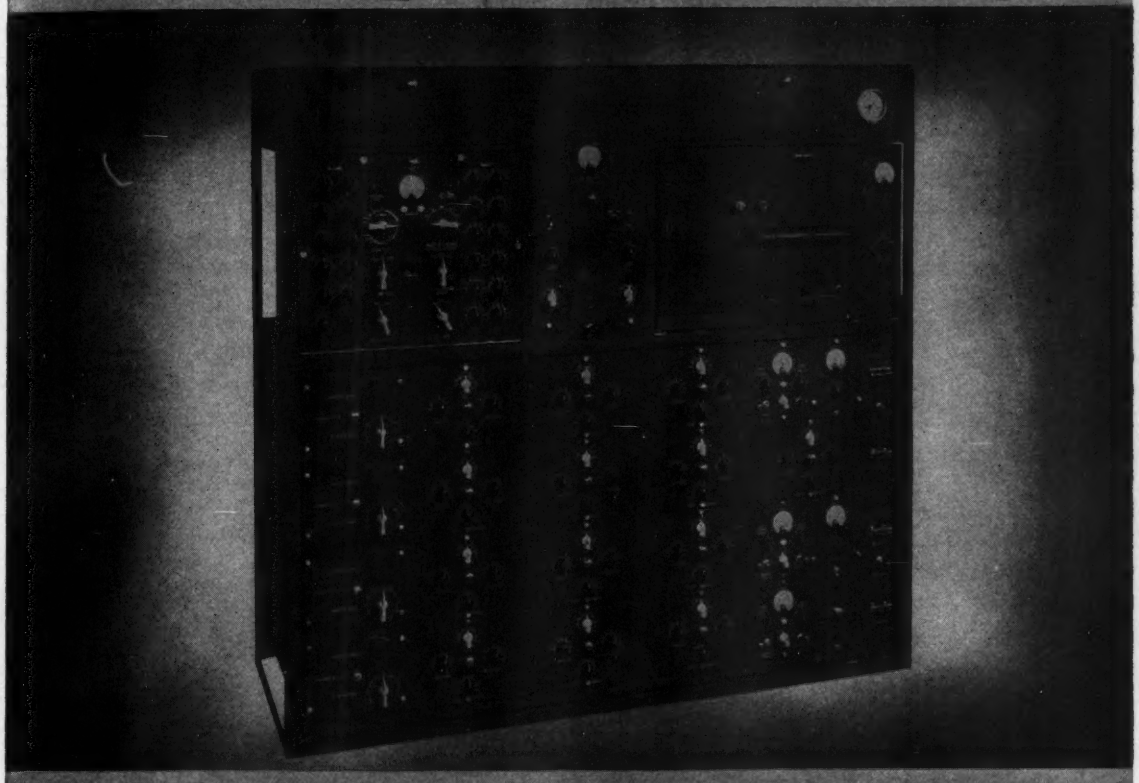

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(3) BUTTONWILLOW GAS FIELD

(Discovered in 1926)

Location: about 30 miles Northwest of Bakersfield and about 8 miles N.N.W. of the town of Buttonwillow. Extends from Sec. 36/27/22 to Sec. 16/28/23. About 1 mile wide.

Topography: Flat sagebrush land.

Type of Gas Accumulation: Anticlinal elongated dome. Gas occurs in 20 foot sand over entire area of field and in several other deeper zones that are very spotted. One zone consists of fractured shale. Pressure partially retained on 20 foot sand by encroaching edge waters.

Geological Horizons Productive: Upper San Joaquin Clays (and sands)—Pleistocene; and Lower San Joaquin Clays—Pliocene.

Thickness of Sands: 5 to 20 feet.

Well Depths: 2408 to 3362 feet. Latter depth is deeper zone. Most wells 2400 to 2500 feet deep.

Number of Producing Wells, 1941: 19.

Gas: 985 B.t.u per cu. ft.

Initial Shut-in Pressure: About 950 lb. sq. in. in 20 foot sand.

Gas Produced in 1941: 2,673,255 M.c.f.

Gas Production to End of 1941: 20,841,578 M.c.f.

Proved Acreage at End of 1941: 1420 acres.

---

(4) CANAL OIL FIELD

(Discovered in 1937)

Location: 14 miles W. S. W. of Bakersfield. Township 30/25, Sec. 11 to 15.

Topography: Flat land covered with sagebrush and mesquite.

Type of Oil Accumulations: Anticlinal, elongated dome. Axis runs about East and West.

Geological Horizons Productive: Stevens Sand-Upper Monterey-Upper Miocene. A test of the Rio Bravo Sand-Vedder-Vaqueros-Lower Miocene proved it barren.

Thickness of Oil Sands: Wells have from 55 feet to 270 feet open, about 75% of which is sand.

Well Depths: 8175 to 8340 feet.

Number of Producing Wells, 1941: 38.

Average Well Size: Maximum efficient rate averages 131 bbls. per well per day.

Gravity of Oil: 34.5° to 37.9° A.P.I.

Method of Production: Flowing.

Bbls. of Oil Produced in 1941: 1,815,894 bbls.

Total Field Production to end of 1941: 6,582,865 bbls.

Proved Acreage at End of 1941: 760 acres.

Total Cumulative Production per acre: 8662 bbls.

---

(5) CANFIELD RANCH OIL FIELD

(Discovered in 1938)

Location: About 12 miles S.W. of Bakersfield and 1 mile east of the Ten Section Oil Field, in Section 27/30/26 M.D. B&M.

Topography: Flat.

Type of Oil Accumulations: Probably a dome. Only one well in the field. Other nearby wells were failures.

Geological Horizons Productive: Stevens Sand-Monterey-Upper Miocene.

Thickness of Oil Sands: 60 feet of formation open.

Well Depths: Plug 8072 feet.

Number of Producing Wells, 1941: 1.

Average Well Size: 29 barrels per day potential and allotment.

Gravity: 25° A.P.I.

Method of Production: Pumping.

Bbls. of Oil Produced in 1941: 15,690.

Total Production to End of 1941: 88,191 bbls.

Proved Acreage at End of 1941: 20 acres.

Total Cumulative Production per Acre: 4409 bbls. per acre.

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(6) CHOWCHILLA GAS AREA

(Discovered in 1934)

Location: Madera County: 14 miles south of Merced, Sec. 7, 8, and 17. T. 10 S., R. 14 E. M.D. B&M.

Topography: Flat.

Type of Gas Accumulations: Nose structure. Plunges to S.W.

Geological Horizons Productive: Miocene sands and Cretaceous sands.

Thickness of Gas Zone: 300 feet, alternating sand and shale in Miocene. 200 feet sand in Cretaceous.

Well Depths: 2400 ft. to 8400 ft. Various zones.

No producing wells at present. 3 wells open to gas zones.

Gas: Methane only hydrocarbon: considerable nitrogen dilution: 930 B.t.u. Initially, well tested 15,000 M.c.f. per day. Lower zone gas only about 480 B.t.u. and thus not commercial.

Total Production to End of 1941: Gas used only for drilling and ranch house. No pipe line to field.

Proved Acreage at End of 1941: Three wells widely scattered. Proved acreage unknown. Estimated at 300 acres.

Pure Oil Company is only operator in area.

---

(7) COALINGA (East-Eocene) OIL FIELD

(East Coalinga Extension-Gatchell Area)

(Discovered in 1938)

Location: Fresno County. E. area. 5 miles N. E. of Coalinga in township 20 S., Range 15 and 16 E., M.D. B. & M.

Topography: Rolling hills.

Type of Oil Accumulations: Accumlation on structural nose with closure on west by change in type of sedimentation, with sands pinching out up dip.

Geological Horizons Productive: Eocene (Gatchell sand)-(Arroyo Hondo).

Thickness of Oil Sands: 0 to 650 feet.

Well Depths: 6960 feet to 8300 feet.

Gravity: 28° to 33° A.P.I.

Gas: Low gas oil ratios, less than 800 cu. ft. per bbl. of oil.

Method of Production: Nearly all are flowing. (See end of Amerada area for production statistics).

(8) COALINGA (Northeast-Eocene) OIL FIELD

(East Coalinga Extension-Amerada Area)

(Discovered in 1939)

Location: Fresno County. 9 miles N.E. of Coalinga. Township 19 S., R. 16 E., M.D. B&M.

Topography: Low rolling hills.

Type of Oil Accumulations: Accumulation on broad structural nose. Closure by change in sedimentation. Sands pinch out on west.

Geological Horizons Productive: Eocene (Gatchell sand)-(Arroyo Hondo).

Thickness of Oil Sands: 0 to 420 feet. Sand including water sand is over 800 feet thick.

Well Depths: 7985 to 8300 feet.

Gravity: 25° to 57° A.P.I.

Gas: Low to high gas oil ratios.

Method of Production: Flowing.

Combined Production Statistics from both Gatchell and Amerada areas:

Number of producing wells: 211.

Average production per well in Dec. 1941: 134.8 bbls. per day.

Water averaged: 5.3%

Bbls. of Oil Produced in 1941: 9,509,761.

Total Production to End of 1941: 18,250,328 bbls.

Proved Acreage at End of 1941: 3775 acres.

Total Cumulative Production per Acre: 4,835 bbls.

---

(9) COALINGA (Old)—EAST, WEST, AND OIL CITY POOLS.

(Discovered in 1896)

Location: Fresno County. Various areas extend from 2 miles S.W. to 12 miles North of Coalinga.

East Portion: E. 2/3 of T. 19 S., R. 15 E. and extending into T. 20 S., R. 15 E.

West portion: S.W. Cor. of T. 19 S., R. 15 E., E. 2 rows of Sections in T. 20 S., R. 14 E., and W. 1¼ miles of T. 20 S., R. 15 E., and N.W. corner of T. 21 S., R. 15 E.

Oil City portion: Sec. 17 and 20, T. 19 S., R. 15 E.

Topography: Flat to hilly.

Type of Oil Accumulations: Coalinga—East (Old): Anticlinal.

Coalinga—West (Old): Monoclinal. Upper edge outcrops. Plugged with asphalt. Some sealing by unconformities.

Coalinga—Oil City Area: Lenses in anticline.

Geological Horizons Productive: East (Old): Temblor.

West (Old): Temblor with some Pliocene sand lenses.

Oil City. Cretaceous.

Thickness of Oil Sands: 0 to 700 feet.

Well Depths: 300 feet to 4300 feet. West edge of West side—300 ft.

Number of Producing Wells 1941: Average actual—849, average potential—1324.

Average Well Size: 18.8 bbl. per day. Cut 49.5% water.

Gravity: 12 to 33° A.P.I.

Method of Production: Pumping.

Bbls. of Oil Produced in 1941: 4,550,816.

Total Production to End of 1941: 364,924,357 bbl.

Proved Acreage at End of 1941: 14,126 acres.

Total Cumulative Production per Acre: 25,820 bbls.

---

(10) COLE'S LEVEE OIL FIELD

(Consists of North Cole's Levee and South Cole's Levee Fields)

(Discovered in 1938)

Consists of two separate structures. North structure formerly known as Richfield Western Area. South structure formerly known as Cole's Levee Area.

Location: East and southeast of Elk Hills Oil Field. 20 miles S.W. from Bakersfield. N. part in T. 31 S., R. 25 E. S. part in T. 32 S., R. 25 E., M.D. B&M.

Topography: Flat and sometimes flooded except extreme westerly portion which extends a short distance up Elk Hills slope.

Type of Oil Accumulations: Two anticlines with East and Southeast axes, respectively. Westerly portion of anticlines probably non-productive because of changing conditions of sedimentation. Sands become less porous and have less permeability at West ends.

Geological Horizons Productive: Various sands in Stevens zone, upper Monterey of Upper Miocene. Pliocene gas sands at about 5000 feet are now being developed.

Thickness of Oil Sands: Varies from 100 to 800 feet, averaging 300 to 400 feet.

Well Depths: North Area: 8895 feet to 9880 feet. South Area: 9178 feet to 10,084 feet.

Number of Producing Wells, 1941: 120 at end of year.

Average Well Size: Maximum efficient rate averages about 184 bbls. per day.

Gravity: From 30° to 60° A.P.I.

Gas: Much commercial gas. West end of South part has high gas oil ratios, production indicating gas cap conditions. Gas/oil ratios from 500 to 16,000.

Method of Production: Flowing wells except in several cases.

Bbls. of Oil Produced in 1941: 5,709,612.

Total Production to End of 1941: 8,834,096 bbls.

Proved Acreage at End of 1941: 5320.

Total Cumulative Production per Acre: 1660 bbl. per acre.

---

(11) DEVILS DEN OIL FIELD

(Discovered in 1901)

Location: About 50 miles Northwest of Taft and 35 miles South of Coalinga. Township: 25/18.

Separate Areas: Old Area: Sec. 25 and 26. Alferitz Area: Sec. 14.

Topography: Old Area: Flat. Alferitz Area: Rolling hills.

Type of Oil Accumulation: Old field—monoclinal, easterly dip. Alferitz area—anticlinal.

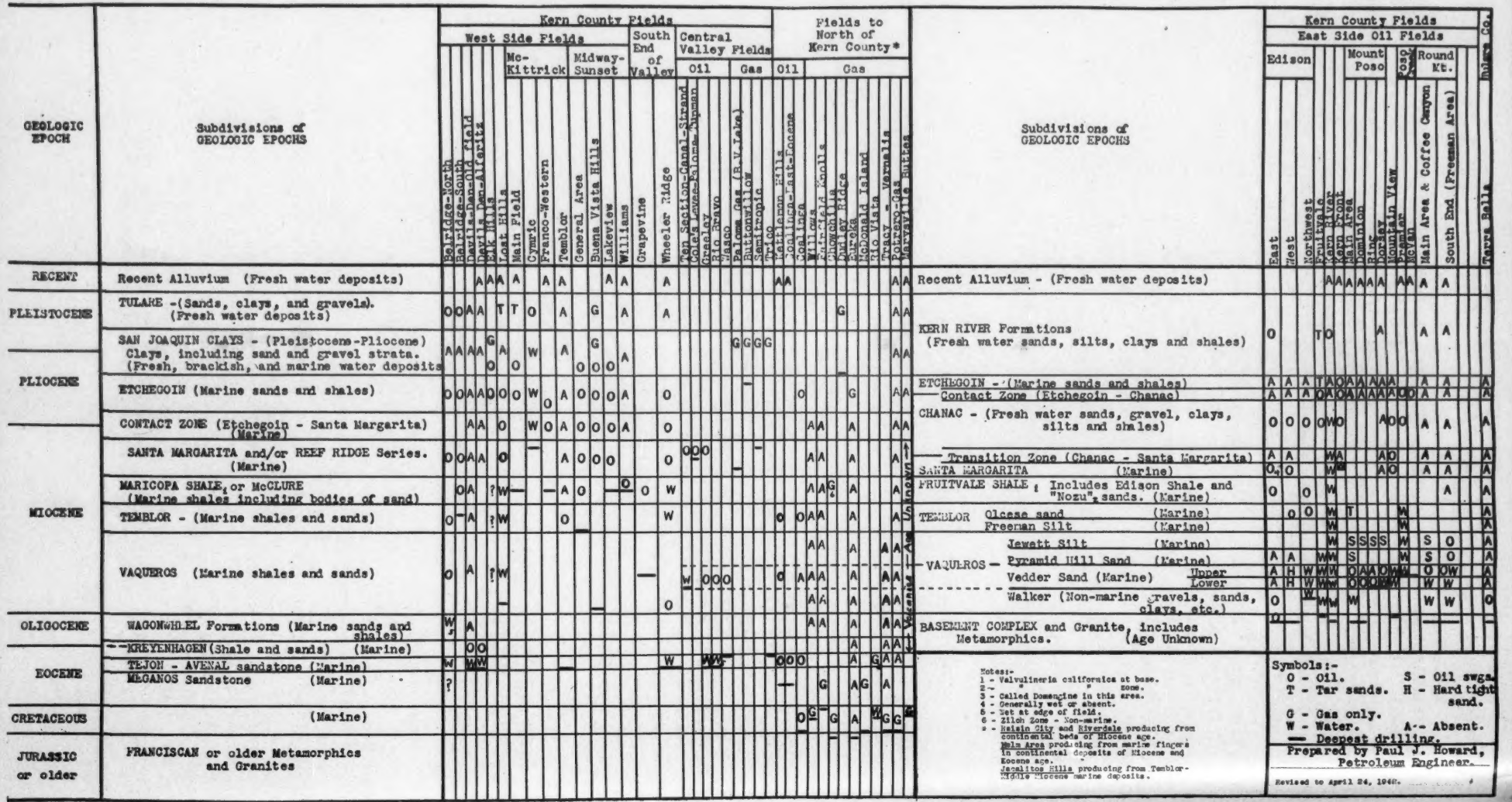
Geological Horizons Productive: Fractured Kreyenhagen shale. In old field there is a little sand. Kreyenhagen is of Oligocene or Eocene age or both.

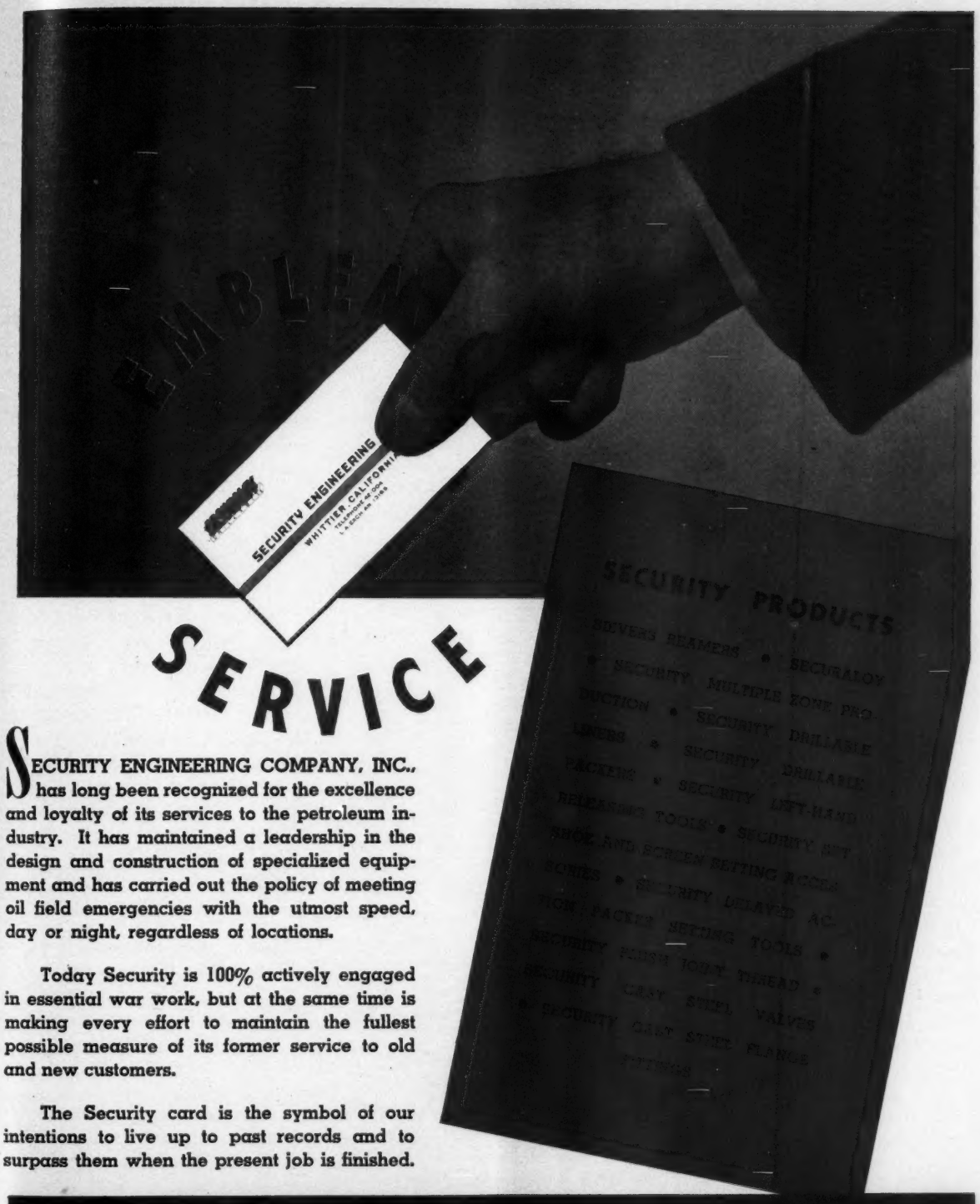
Thickness of Oil Sand: Most wells are in fractured shale but some show 8 to 18 feet of sand or sandy shale.

Well Depths: Old field 140 to 200 feet. Alferitz Area 2037 and 2554 feet.

KERN COUNTY ASSESSOR'S OFFICE

Geologic Horizons of Oil and Gas Fields of San Joaquin Valley and Farther North





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Number of Producing Wells, (1941): 8.

Average Well Size: 4.6 bbls. per day.

Gravity of Oil: 14° to 15° in Old Field. 17.2° in Alferitz Area.

Method of Production: Pumping.

Bbls. of Oil Produced in 1941: 7360. Cut about 48% water.

Total Production to End of 1941: 78,222 bbls.

Proved Acreage at End of 1941: 120.

Total Cumulative Production per Acre: 652 bbls.

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(12) DUDLEY RIDGE GAS AREA

(Discovered in 1930)

Location: Kings County. Extends from Sec. 2 and 11, T. 23 S., R. 19 E. to Sec. 7, T. 23 S., R. 20 E., M.D.B.&M.

Topography: Flat. Part of field under Tulare Lake much of time.

Type of Gas Accumulations: Anticline.

Geological Horizons Productive: Base of Tulare—Pleistocene.

Thickness of Gas Zone: About 50 feet. Wells were not cored.

Well Depths: 1190 to 1250 feet. Blowout occurred at about 3200 feet while making deep test.

Number of Producing Wells, 1941: None.

Gas: About 985 B.t.u.

Gas Produced in 1941: None.

Total Production to End of 1941: 2,053,500 M.c.f. (estimated).

Proved Acreage at End of 1941: Possibly 1500 to 2000 acres. Extent of deep zone unknown.

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(13) EDISON OIL FIELD

(Discovered in 1934)

Location: Ten miles E.S.E. of Bakersfield. Tp. 30/29.

Separate Areas: East Edison: Sec. 10, 13, 14, 15, 22, 23, and 24.

West Edison: Sec. 16 and 21.

Sec. 5 Areas: 9 scattered wells in spotted areas. Wells in Sec. 5 and 6, 30/29 and Sec. 32, 29/29.

Topography: Sloping flat lands just West of foothills.

Type of Oil Accumulations: East Edison: Quite lenticular sands in homoclinal strata dipping Southwest. Sands appear generally to be old shore line deposits which pinch out to the Northeast. Faulting plays a minor part in the accumulations. Deeper sands lie farther West.

West Edison: Homoclinal accumulations on West side of fault which runs North to Northwest.

Geological Horizons Productive: East Edison: Kern River series including Chanac — (Pliocene) main source of oil. Oil is from several zones. Santa Margarita — Upper Miocene productive in isolated spots. Some oil comes from Jewett Silt — Vaqueros — Lower Miocene. Some oil accumulated in the terrestrial Walker, sands and gravels—Vaqueros, which immediately overlie the granite.

West Edison: Chanac, Santa Margarita, and Temblor.

Thickness of Oil Sands: 50 to 500 feet of formation open. Probably averages about 35% sand.

Well Depths: East Edison: 1000 to 3576 feet. West Edison: 2890 to 4255 feet.

Number of Producing Wells, 1941: 103. Potential: 115.

Average Well Size: 32 bbls. per day. Cut 38% water.

Gravity of Oil: 14° to 28° A.P.I. No commercial gas production.

Method of Production: Pumping.

Bbls. of Oil Produced in 1941: 1,036,573.

Total Field Production to End of 1941: 8,654,156 bbls.

Proved Acreage at End of 1941: 1270.

Total Cumulative Production per Acre: 6,980 bbls.

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(14) ELK HILLS OIL FIELD

(Discovered in 1910)

(Not actively developed until 1919)

Location: About 20 miles W.S.W. of Bakersfield and 10 miles N.E. of Taft.

Township: 30/23, Sec. 25, 26, 35, and 36.

Township: 31/23, Sec. 1, Township 30/24, Sec. 25-36, incl. Township 31/24, Sec. 1-6, incl. Township 30/25, Sec. 31. Township 31/25, Sec. 6.

West part of above area is known as central portion of Elks Hills or Carman-Hay Area. Field possibly extends many miles West of area listed above but is held as U. S. Naval Reserve. There is much undeveloped land between the East end of Elk Hills and the Carman-Hay Area.

Topography: Rolling to steep hills.

Type of Oil Accumulation: Anticlinal. Many faults effect accumulation and drainage to some extent. Axis runs almost E. and W. Plunges to East.

Geological Horizons Productive: East End: Scalez Zone — Pliocene portion of San Joaquin clays, and Etchegoin-Pliocene. Central Portion: Etchegoin-Pliocene. Some deeper production has recently been developed.

Thickness of Oil Sands: Oil sands occur in a zone running to 450 feet thick but sands themselves are probably not over 60 feet thick. Amount of sand that can be produced depends upon water conditions.

Well Depths: 2900 to 3500 feet.

Number of Producing Wells at End of 1941: 148. Potential 288.

Average Well Size: 63.7 bbls. per day. Cut 63% water.

Gravity of Oil: 15.4° to 35.4° A.P.I. Commercial gas is available though little is produced at present.

Method of Production: Pumping.

Bbls. Oil Produced in 1941: 3,491,582.

Total Field Production to End of 1941: 157,125,094 bbls.

Proved Acreage at End of 1941: 7480.

Total Cumulative Production per Acre: 21,000. (Production per acre in developed portion will be much higher.)

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(15) EUREKA GAS FIELD

(Discovered in 1937)

Location: About 12 miles South of Eureka, in Humboldt County.

Topography: Rolling hills.

Type of Gas Accumulation: Probably anticlinal.

Geological Horizons Productive: Pliocene sands and silts.

Thickness of Gas Sands: Zone 3800 Ft. to 5000 Ft. About 110 ft. of sand.

Well Depths: 5000 Ft. Discovery well plugged back from 7708 ft.

Number of Producing Wells 1941: 3 potential, 2 actual.

Gas: Dry gas, about 940 B.t.u. per cu. ft.

Gas Produced in 1941: 77,190 M.c.f.

Total Production to End of 1941: 182,752 M.c.f.

Proved Acreage at End of 1941: Estimated from 400 to 800 acres.

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(16) FAIRFIELD KNOLLS GAS AREA

(Discovered in 1937)

Location: Yolo County. 8 miles S.W. of Woodland. Sec. 32, T. 9 N., R. 1 E., M.D. B&M.

Topography: Very low rolling hills.

Type of Gas Accumulation: 1 well field. Structure yet unknown.

Geological Horizons Productive: Eocene sands. (Miocene sands absent). Tested just into Cretaceous.

Thickness of Gas Sands: 25 feet.

Well Depths: 1 well. 5181 ft. redrilled to 3700 ft.

Number of Producing Wells, 1941: 1 potential producer.

Average Well Size: Tested 6,500 M.c.f. per day, then shut-in.

Gas: 935 B.t.u.

Gas Produced in 1941: None.

Total Production to End of 1941: 14,333 M.c.f.

Proved Acreage at End of 1941: Estimated about 150 acres.

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(17) FRUITVALE OIL FIELD

(Discovered in 1928)

Location: About 2 miles West of Bakersfield. Township: 29/27.

Separate Areas: Main Area: Sec. 21, 22, 26, 27, and 28. Fairhaven: Sec. 14, 15, 22, and 23.

Topography: Flat river bottom and delta. Portions of Field easily flooded.

Type of Oil Accumulations: Several zones of different relative depths on a nose which plunges to the West. Oil accumulations in these zones are limited in areal extent and no oil zone can be said to be continuous over the entire field. The Main Area of the Field is limited on the East by a fault running approximately through the center of Sec. 22 and about ¼ mile North of the center of Sec. 26. The Fairhaven Area is limited on the East by a fault running approximately through the N. ¼ cor. and S.E. cor. of Sec. 23.

Geological Horizons Productive: Tar sands occur in the Etchegoin (Jacalitos) — Pliocene above the Chanac contact but the true oil sands start with the Contact zone and extend, at intervals, downward through the Chanac (terrestrial)—Pliocene and upper Miocene. Underlying marine Santa Margarita-Upper Miocene is unproductive. The zones are called by the following names in order of depth: Fairhaven or Contact, Parker, Martin, and Kernco.

Thickness of Oil Sands: Separate oil zones being produced vary from 25 to 400 feet in thickness.

Well Depths: 2690 to 4200 feet.

Number of Producing Wells, 1941: 161. Potential: 183.

Average Well Size: 43.9 bbls. per day. Cut 44% water.

Gravity of Oil: 14.5° to 24.8° A.P.I.

Method of Production: Most wells completed as pumping wells although a number of wells flow. Many wells produce sufficient gas for lease use but there is no real commercial production of gas.

Bbls. of Oil Produced in 1941: 2,099,040.

Total Field Production to End of 1941: 22,823,067 bbls.

Proved Acreage at End of 1941: 1364.

Total Cumulative Production per Acre: 18,210 bbls. if prorated to present acreage.

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(18) GRAPEVINE OIL FIELD

(Discovered in 1936)

Location: 28 miles South of Bakers field and about 2 miles East of 99 Highway. Township 11/19, Sec. 33.

Topography: Gently sloping range land.

Type of Oil Accumulation: Probably very limited lenticular deposit which may be greatly complicated by faulting. Homocline dips to North.

Geological Horizon Productive: Middle Monterey—Miocene. Production is from above the valvulineria californica zone.

Thickness of Oil Sand: Up to 200 feet of formation open.

Well Depth: 4431.

Number of Producing Wells: Only one left at end of 1941.

Well Size: Well good for about 16 bbls. per day.

Gravity: 22° A.P.I.

Method of Production: Pumping.

Bbls. of Oil Produced in 1941: 5875.

Total Field Production to End of 1941: 92,061 bbls.

Proved Acreage at End of 1941: 10 acres.

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(19) GREELEY OIL FIELD

(Discovered in 1936)

Location: 10 miles West of Bakersfield. Greeley zone in Sec. 16, to 20 incl. 29/26 M.D. B&M.

Vedder Zone extends from Sec. 1/29/25 to 20/29/26.

Topography: Flat. Mostly covered with sagebrush.

Type of Oil Accumulation: Greeley Zone is a shore line deposit, on nose which pinches out on the East side along a straight line running through N.E. cor. and S.W. cor of Sec. 20. Deeper zone—Rio Bravo and Vedder—Vaqueros age is an anticlinal accumulation with a fault on N.E. flank. Axis is N.W.-S.E. Rio Bravo sand in N. 2/3 of field only. Field about ¾ mile wide with a saddle in the middle. Rio Bravo zone extends beyond Vedder zone in North half of field.

Geological Horizons Productive: Stevens Sand-Upper Monterey-Miocene. Rio Bravo Sand and Vedder sand, both of Vaqueros-Lower Miocene age.

Thickness of Oil Sands: Stevens Sand: 40 to 170 feet of zone taken of which about 75% is sand.

(Continued on Page 21)

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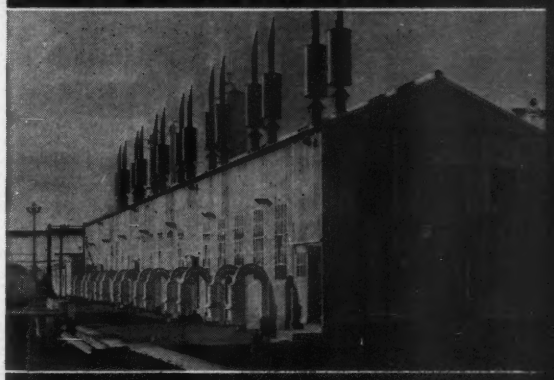
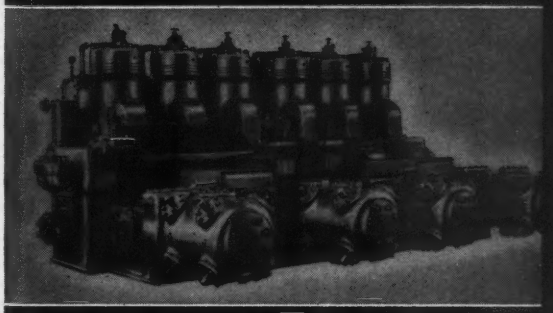


This building, only 24 feet wide, houses 7 600 H. P. CLARK "Angle" Compressors, totaling 4,200 H. P.



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The Application of Corrosion Resistant Alloys to Natural Gasoline Plants

By

B. B. Morton,
Development and Research Division,
The International Nickel Co., Inc.,
New York, N. Y.

Presented at the August Meeting of the California Natural Gasoline Association

Natural gasoline plants are subject to several types of corrosion as a result of the presence of moisture, sulfur and salts encountered in the materials handled. The industry is very wide-spread and the corrosion problems, therefore, are varied.

In attempting to outline uses of corrosion resistant alloys for this industry, experience with gasoline recovery units within refineries is drawn upon since it is felt that there is a parallel in operating problems. The corrosion within the refinery units is probably more severe than that encountered in the natural gasoline units, due to the presence of organic acids and sulfur compounds not encountered in the field.

The discussion that follows ignores, in part, the shortage of materials resulting from the war effort. While this shortage cannot be ignored in actual operation, it is felt that for the sake of the record it is well to outline the behavior of materials without regard to their present scarcity or priority standing.

Corrosion—General

The corrosion occuring in a natural gasoline plant can be divided into two categories as:

(1) Corrosion occurring in the presence of liquid water.

(2) Corrosion occurring in the absence of liquid water.

Corrosion occurring in the presence of liquid water is of the electrolytic type and responds to the factors of aeration, temperature and velocity. It is markedly affected by the hydrogen ion (pH) value of the liquid.

Corrosion occurring above the dew point of the water is often of the replacement type in which an oxide, sulfide or other compound of the metal is formed.

Electrolytic Corrosion

Where water, suitably contaminated to be an electrolyte, is in contact with metal, a condition exists conducive to electrolytic corrosion. Due to peculiarities of the metal some regions act as anodes; other regions act as cathodes. As a result, a current flows and metal tends to go into solution at the anode, while plating of a metal or of hydrogen tends to take place at the cathode.

In amplification of the above, a metal tends to go into solution, acquire a charge and become ionized. This reaction is referred to as the anodic reaction. The ions of the solution will give up positive charges to provide for the charge of the new metal. Simultaneously, hydrogen or some relatively more noble metal will be plated out, or discharged at the cathode. This is referred to as the cathodic reaction.

There is a tendency to differentiate between electrolytic corrosion occurring on a piece of metal as the result of difference of potential of local spots and corrosion taking place between two pieces of dissimilar metal electrically connected. The case of the single piece of metal can be thought of as the normal type of corrosion for the sake of distinction, and the case of the two metals can be referred to as galvanic corrosion. These nomenclatures will be adhered to in the subsequent discussion.

Galvanic Corrosion

Galvanic corrosion, defined here as the corrosion taking place as the result of the contact of dissimilar metals in an electrode, is marked by the accelerated corrosion of the less noble members, the anode, and the retarded corrosion of the more noble metal. In fact it may be said that the distinguishing feature of galvanic corrosion lies in the fact that the anode reaction (solution of metal) is concentrated on the less noble metal, while the cathode reaction (plating of hydrogen or a metal) is concentrated on the more noble metal.

Galvanic corrosion is influenced not only by temperature, velocity and aeration, but by other factors peculiar to itself. These may be listed as:

1. The difference in potential between the elements of the couple.

2. The resistance in the circuit.

3. The relative areas of the electrodes.

4. The deposit of insoluble material on the anode or cathode.

5. The polarization characteristics of the metals and the solution under exposure conditions.

6. The overvoltage values for the metal forming the couple.

A number of the factors listed above may be in operation at once, which explains the complications surrounding galvanic corrosion.

In an exceedingly brief manner, some comment will be offered on the factors influencing galvanic corrosion.

Consider the galvanic series listed in table I. Experience has shown that materials closely grouped, as for instance in the aluminum group, have little effect upon each other, regardless of their relative positions. However, a member of a group, as steel, will be considerably affected by being coupled with a member of the copper-brass group. This demonstrates the effect of the differences in potential.

TABLE I

Galvanic Series for Sea Water

Magnesium
Magnesium Alloys
Zinc
Galvanized Steel or Galvanized Wrought Iron
Aluminum 52SH
Aluminum 4S
Aluminum 3S
Aluminum 2S
Aluminum 53ST
Alclad
Cadmium
Aluminum A17ST
Aluminum 17ST
Aluminum 24ST
Mild Steel
Wrought Iron
Cast Iron
Ni-Resist
13% Chromium Stainless Steel, Type 410 (Active)
50-50 Lead Tin Solder
18-8 Stainless Steel, Type 304 (Active)
18-8-3 Stainless Steel, Type 316 (Active)
Lead
Tin
Muntz Metal
Manganese Bronze
Naval Brass
Nickel (Active)
Inconel (Active)
Yellow Brass
Admiralty Brass
Aluminum Bronze
Red Brass
Copper
Silicon Bronze
Ambrac
70:30 Copper Nickel
Comp. G Bronze
Comp. M Bronze
Nickel (Passive)
Inconel (Passive)
Monel
18-8 Stainless Steel, Type 304 (Passive)
18-8-3 Stainless Steel, Type 316 (Passive)

Fig. 3—Cast Iron with Layer of Graphite Present After Corrosion.

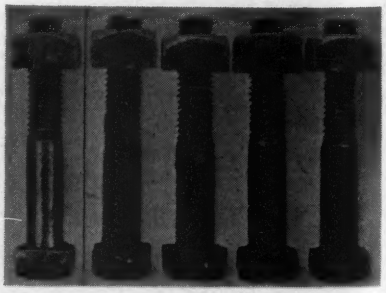

Fig. 4—Exposed 22 years in a condenser box to contaminated salt water of the Kill van Kull. Monel Bolts.

Fig. 5—Showing Plug-Type Dezincification. (Magnification 3X).

Fig. 6—Showing Pitting as a Result of Deposit Attack. (Magnification 3X).

The matter of resistance, item 2 above, is fairly obvious. It points to widely used methods of combating galvanic corrosion by using insulators as paints and other materials. In this connection it can be profitably pointed out that painting or insulating the **cathode,** i.e., the noble material often offers the greatest benefit. As fairly obvious as this procedure becomes upon some thought, it must be admitted that the general practice is to paint or cover the anode (less noble metal). The reason is that the more noble metal is used to resist some media and it appears illogical to cover it.

The effects of relative areas, item 3, is fairly clear. A steel bolt in a copper sheet exposed to sea water would be rapidly destroyed. However, a copper bolt in a steel sheet in sea water would produce but negligible increase of normal corrosion of the steel.

Insoluble deposits, item 4, on the anode or cathode can block further galvanic corrosion by the reduction of effective area, the increase of circuit resistance, the mechanical resistance to the exchange of ions, or a combination of these means. Lead in sulfuric acid of certain concentrations forms an insoluable sulfate which retards further corrosion and renders lead a useful metal in contact with this acid.

Where plating of hydrogen takes place on the cathode, it can retard the corrosion reaction. This hydrogen must be removed by oxygen or by formation and evolution of molecular hydrogen for the reaction to proceed.

The discharge of hydrogen at the cathode area may result in the solution at the cathode becoming alkaline due to hydroxyl ions concentrating. In the case of iron, this may result in precipitating insoluble corrosion products.

Polarization, the difference between the potential of an electrode during flow of current and the potential under steady state conditions with no current flowing, is often of controlling importance. When polarization curves are plotted, potential vs. current density for metals under controlled conditions, data are deducible that will permit estimation of corrosion under similar conditions.

During corrosion reactions where hydrogen evolution is the principal cathode reaction, the hydrogen overvoltage values of the cathode material may be an important factor. Hydrogen overvoltage may be defined as the additional potential, above the theoretical, required to produce hydrogen evolution at the cathode. The value of the "overvoltage" varies with the material and the condition of the surface. It can be seen that the conditions which favor overvoltage are unfavorable to the corrosion reaction and hence may be viewed as beneficial to the life of the metal.

Normal Corrosion

Normal corrosion, defined here as the electrolytic form acting upon a single composition of metal, is affected largely by the items listed in connection with galvanic corrosion, but it is generally more difficult to distinguish which areas of the surface are acting as anodes and which as cathodes. Attention should be directed to special cases where a metal has a degree of nobility conferred upon it by the presence of a film of oxide or of other material. The high chromium alloys represent a case. It will be noted, for example, in the galvanic series of Table I that types 304 and 316 stainless steel occupy one position when active, i.e., free of oxide film, and a more noble position when passive, i.e., protected by an oxide film. It is evident that a high order of potential would exist at a break in the film that would be unfavorable to the metal. This points to the advantage of using these materials in a media possessing a supply of oxygen or other suitable material to maintain and repair the protective film.

Pitting is a common form of corrosion in the case of materials depending upon a film more noble than the metal itself for protection. In this case, the interior of the pit functions as the anode and the filmed surface as the cathode.

Concentration Cells

Concentration cells are an important factor in corrosion, especially in the case of copper and high copper alloys.

Concentration cells are explained on the basis of an attempt to reach an equilibrium of metallic ion in a solution. This type of corrosion occurs when a metal contacts a dense concentration of ions at one point of a solution and also contacts another part of the solution which is lower in ion concentration. Ions tend to leave the metal in the lower concentration region to build up to a uniform concentration. It is clear that if the concentration is maintained constantly lower as by flowing of the fluid, severe wastage

Fig. 7—Showing Impingement Attack at Entrance of Condenser Tube (Magnification 3X).

of the metal will occur at the region of lower ion concentration.

Concentration cell corrosion can explain many cases that cannot be accounted for by galvanic or normal corrosion. A semi-stagnant location in a stream is an ideal location for instituting this type of corrosion. The effects will be somewhat removed from the stagnant location.

Variations of oxygen content are also credited with establishing "oxygen cell" corrosion. The theory is that the oxygen may be used in reactions with hydrogen at the cathodes; hence the region of high oxygen concentration becomes cathodic to the regions of lower concentrations.

Protecting Against Galvanic Corrosion

While galvanic corrosion is a source of intense corrosion of the less noble metal, the principles involved can also be utilized to retard or prevent corrosion of a given part.

The use of galvanized steel is an example of protecting a metal by a less noble protective coating.

Rather obviously, the larger the area of the less noble metal in respect to the nobler metal, the less marked is the effect of the corrosion, provided all of the area is effective to distribute the corrosion. Scrap iron is sometimes used to extend the attacked area or to utilize some of the hydrogen.

Zinc is quite often used to protect parts. To make the sacrificial metal most effective, it should possess as large area as conditions permit. It should be well connected to the part to be protected and as close as permissible to the part. The surface of the zinc should be kept free of coatings or incrustations. In general: Form as efficient battery as possible and recall that the protection of the valued part can only be accomplished by the destruction of the less noble material.

Paints are widely used to protect parts. The use requires some thought if real good is to be accomplished. As has been previously mentioned, painting of an active cathode often is more logical than painting the less noble anode. Imperfections in the paint job will be less injurious. Mr. LaQue, of the International Nickel Company, has outlined some views on the use of paint that follow:

1st Choice: Paint both the materials of the galvanic couple.

2nd Choice: If it should not be practical to paint both metals, paint the more noble one in preference to the less noble one.

3rd Choice: Don't paint at all unless it has been established beforehand that the coating applied to the less noble metal will provide perfect and complete protection for the required length of time.

Replacement Corrosion

Metals operating at elevated temperatures in the absence of liquid water are often attacked by sulfur compounds or by oxygen. Additions of chromium to the analysis are generally made to combat these conditions. The resistance of the metal increases with increasing chromium contents. The first two per cent additions often give the most marked improvement. Following additions give increased resistance but at a decreased rate.

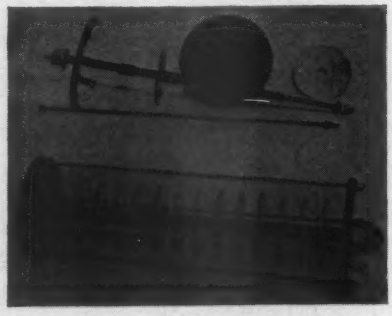

Figure 10

Molybdenum is often added to the chromium containing steels to reduce "temper brittleness" and, where needed, to enhance the "creep" strength.

The 18 percent chromium-8 per cent nickel alloys are most resistant to sulfur. Where organic acids are also present at elevated temperatures (above, say 500° F.), additions of 2-3 percent of molybdenum make for improved performance.

Parts of compressors represent locations in natural gasoline plants where corrosion, at elevated temperature in the absence of liquid water, takes place.

Ni-Resist cast iron is a favorable material for liners of compressors handling sour gases. Where "dry back" liners, i.e., liners not exposed to cooling water, are used, the coefficient of thermal expansion of this austenitic cast iron must be considered. The coefficient is approximately 50 percent greater than for gray cast iron. The coefficient can be changed by varying the composition.

Compressors using Ni-Resist liners, piston and rings have given very favorable service under intensely corrosive conditions.

Valves of 80 percent nickel-20 percent chromium, or a modification of this composition, of Inconel (80 percent nickel-13 percent chromium), and of Monel are widely used, especially in refinery services.

Alloyed cast irons containing, for example, 1.50 percent nickel, 0.60 percent chromium, enter into highly stressed parts of compressors.

Materials of Construction
Cast Iron

Cast iron is widely used in all manner of construction. Its use is justified by its economic position, its good resistance to many varieties of corrosion and its availability.

From a mechanical standpoint, cast irons, properly made and suitably alloyed, have good tensile strength, excellent compressive strength and other desirable properties. Lack of ductility limits the usefulness of this metal.

The graphitic form taken by the corrosive products of cast iron renders it a most useful material for many applications. During corrosion there is often a replacement of oxide or other material for the iron removed. The graphite of the iron is left in place. The result is a porous structure often having the shape of the original piece but lacking any particular strength (Fig. 3).

The graphitized material may decrease or prevent further corrosion of the cast iron. This occurs when the graphitic coating reaches some depth and can be accounted for by the fact that the trans-

fer of attacking reagent through the porous coating is of necessity slowed down. When the pores are very small or are plugged in whole or part, the cast iron parts may greatly outlive steel parts in a given location.

A study of Table II will indicate that while the graphitic coating often acts as a deterent to corrosion, this layer is quite noble compared with metallic cast iron. From Table II it will be noted from item (1) that the corrosion rate of iron with a graphitic coating is less than (2), an iron freshly machined. Items (3), (4) and (5) indicate the accelerating effect of coupling cast iron free from a graphitic layer with iron containing such a layer. Subsequent to (5) it may be assumed a rate similar to (1) will be obtained due to building up a layer.

Fig. 4 shows some Monel* (69 percent nickel-29 percent copper alloy) bolts after twenty-two years of service in the contaminated salt water of Kill Van Kull. The service of these bolts indicates a use for galvanic differences. The bolts are noble to cast iron; hence they are galvanically protected when installed with cast iron flanges. The accelerated corrosion of the cast iron is of little importance due to the vaster area of the iron and also to graphitic products of the corrosion.

Highly alloyed cast iron, such as the austenitic, non-magnetic form, Ni-Resist* (15 percent nickel-6 percent copper-2 percent chromium), is widely used in connection with corrosive sea water. This iron possesses a high degree of corrosion resistance per se, and in addition has less potential difference between the iron and the graphitic corrosion product than exists in the case of gray cast iron. The lower potential is favorable to reduced corrosion rates and is considered an important factor when conditions of the larger are such as to enhance the orrosion rate by autogenous galvanic means.

Ni-Resist finds wide application as pump and compressor parts. It is particularly useful as a valve material to handle sulfuric, caustic and corrosive distillates.

High Copper Alloys

Most processes dealing with petroleum and its products involve additions of heat and extraction of heat. The addition and subtraction of heat both present problems in metallurgy. Probably the extraction presents more numerous and complicated problems, since electrolytic corrosion occurs in many condensers and coolers when water is the coolerant.

Admiralty metal (70 per copper-29 percent zinc-1 percent tin) is largely used as the material for condenser tubes. This alloy suffers three distinct types of corrosion under appropriate conditions. These three types are dezincification (general and plug type), pitting (frequently at breaks in deposit), and impingement attack (at inlet and when high inlet velocity of water exists). In the absence of these forms of attack, general thinning occurs over a period of time. Figs. 5, 6 and 7 illustrate the three types of failure mentioned above.

Admiralty tubes, while possessing good resistance to many petroleum products, are subject to dezincification in the presence of condensed water from the petroleum fraction or by the cooling waters.

Dezincification apparently occurs by a copper-zinc alloy corroding as a unit, following which copper is selectively deposited on the alloy to form a spongy mass. A somewhat similar reaction has been noted in the case of 70/30 copper-nickel tubes and has been referred to as denickelization. The removal of nickel with the deposition of copper apparently requires special and suitable conditions due to the potential relationship of the 70/30 alloy and copper.

The use of "red brass" is a logical step that has been taken to combat dezincification. Unfortunately sulfur compounds in petroleum fractions apparently attack the red brass with such vigor as to render the expedient useless in many cases. In some places, where condensation of water from the petroleum vapor is not important, duxplex tubes of varying compositions for the members of the tube can be used with profit.

Where alkalis as caustic ammonia and others are introduced with the petroleum

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Table II.
Results of Tests of the Effects of a Graphitic Layer upon the Corrosion Rate of Cast Iron

	Milligrams Per Square Decimeter Per Day
1. Normal corrosion rate of graphite-coated cast iron	74
2. Normal corrosion rate of freshly machined cast iron	167
3. Corrosion rate of freshly machined cast iron in contact with equal area of graphite-coated cast iron (average over 9-day tests)	535
4. Initial galvanic corrosion rate	6,900
5. Final galvanic corrossion rate	372

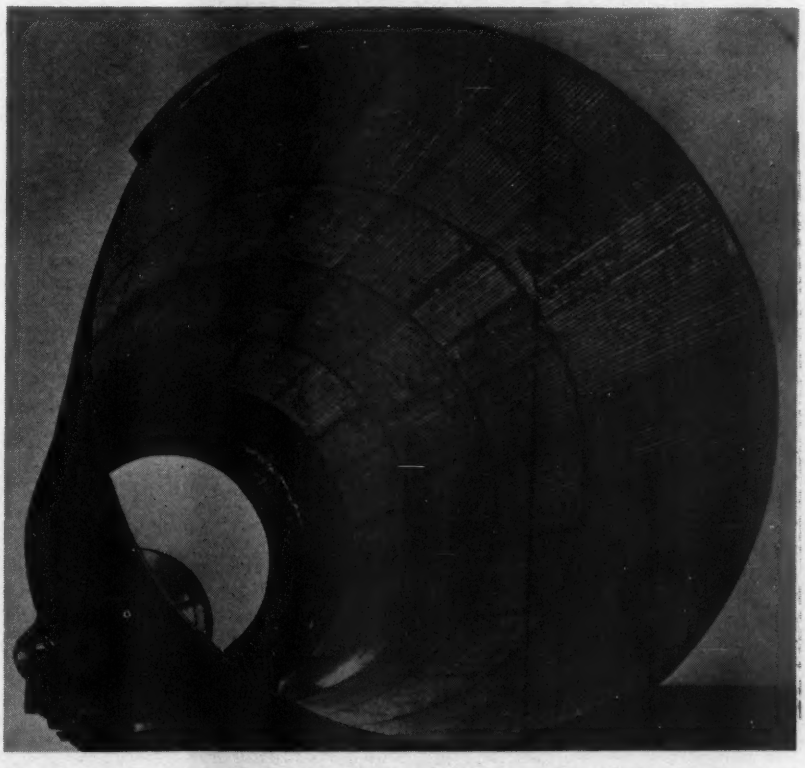

Fig. 11—Section of a large fractionating tower the top part of which is "Smith-lined" with Monel sheet to withstand corrosion by dilute HCl. Monel tower linings are confined to top sections where temperatures do not exceed 500°F.—Courtesy A. O. Smith Corp., Milwaukee, Wisc.

fractions, duplex tubes with steel on the petroleum side and a high copper alloy on the water side are indicated. Considerable interest centered on duxplex tubes and many manufacturers were giving the matter considerable attention prior to the war.

Tests indicate that general dezincification can be suppressed by additions of elements as arsenic, antimony, or phosphorous. Tin is also considered to possess some merit in this connection.

Dezincification can be general or local. If local, "plug" type of pitting results and is quite destructive. Plug type pitting results from local conditions of the metal as non-uniform oxygen distribution.

Foreign matter lodged in a condenser tube is a serious matter. Destruction can take place in the vicinity of the material by cavitation if rapid flow is taking place. Cell effects, either iron cells or oxygen cells, are favored by foreign matter or uneven spots due to scale or mechanical abuse on the water side.

Entrained air or gases contribute greatly to impingement attack. It is especially advisable to remove gases by traps or other devices when the cooling water is to be raised to fairly high temperatures.

Tubes of 70 percent copper-30 percent nickel, while exhibiting on the whole an erratic behavior, are gaining in use where a single metal tube is desired. These tubes resist caustic well, are not subject to dezincification and seldom to denickelization, are very resistant to impingement and behave well in the presence of brackish and other salt waters. The history to date indicates 70/30 copper-nickel tubes are quite superior to 80/20 copper-nickel ones in petroleum service.

The 70/30 copper-nickel tubes, in general, can be expected to give a life of 2.5-6 times that obtained from admiralty service in many petroleum applications.

Some factors that contribute to shorten the life of copper alloy tubes are:

1. High water temperatures 160-180° F.
2. High velocity of water.
3. Large volume of entrained air (Air and gases are released as the temperature of the water rises and should be vented.)
4. Foreign material, scale patches and rough places in tubes. (Both impingement and cell corrosion can result.)
5. Certain bases can destroy copper-zinc alloys.
6. Locked up drawing stresses can result in corrosion cracking of nearly all non-ferrous alloys.

Condensers

Often condensers have cast iron shells and admiralty or other copper alloy tube bundles. To protect the shell, a base is sometimes introduced. This is a dangerous procedure as the tubes may suffer. A safer practice appears to be to line the shell with Monel and to introduce the base at the discharge. The linings are installed in many cases by plug welding locally. Use of Monel clad steel results in a neater job. Monel plate welded is used where thin walls are desired, thus making use of the high strength (70-75,000 p.s.i. ultimate strength) of the alloy.

Piping and fitting of Monel are utilized to handle corrosive products in refineries.

Test Results

Due to the complex nature of petroleum, its products and the corrosive agents occurring in connection with them, it is most difficult to predict accurately the type of corrosion resisting material to be used.

The test spool shown in Fig. 10 has been widely employed in the petroleum industry and many data have been accumulated. Some results are reported in Tables III, IV, V, VI and VII.

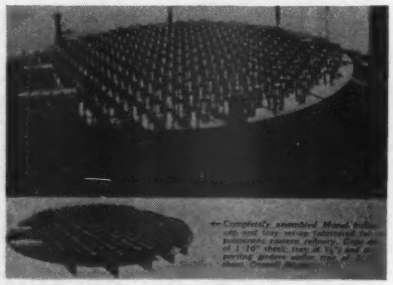

Fig. 12—Completey assembled Monel bubble cap and tray set-up fabricated for a prominent eastern refinery. Caps are of 1/16" sheet; tray of 1/8"; and supporting girders under tray of 3/16" sheet. Overall diameter 13'.

As the result of tests similar to the ones reported in the tables, a wide-spread and judicious use of alloys has been made. Fig. 11 shows a large tower lined with Monel at the top and stainless steel at the bottom. Fig. 12 shows some trays and caps of Monel. These are used in the top of towers to resist the corrosives carried back by the reflux.

The general experience has been that Monel is useful below a temperature of 500° F. Above this temperature sulfur attack becomes a factor and chromium containing alloys are indicated.

Some application of Monel within its prescribed temperature limit are: liners for tops of towers and as caps and trays in the top section; liners for "down comer" lines and shells of condensers; liners for circulators and water separators; cables and floats in storage tanks, orifices of meters and many other uses including nails of the "anchor fast" type used to construct boats and similar equipment exposed to salt water. Cooling towers offer a logical application for these nails.

Conclusions

In this paper it is recognized that corrosion occurring in a natural gasoline plant is largely of the electrolytic type.

Table III

Product—Straight Run, 63° A.P.I. Gasoline.
Temperature—375° F.
Location of Spool—Lower Section of Tower.
Time—318 days.
Agitation—Common to space between trays.

* * *

Metal	Pent. Ins. per year
Mild Steel	0.021
Monel (69% Ni-29% Cu)	0.004
Nickel	0.004
Inconel (79% Ni-13% Cr)	0.005
Admiralty Metal	0.008
Cast Iron	0.006
Ni-Resist Cast Iron (15% Ni-6% Cu-2% Cr)	0.002

Table IV.

Product — Straight Run Gasoline plus H_2S.
Temperature—125° F. (avg.)
Location of Spool — Lower Section of Condenser.
Time—253 days.
Agitation—Due to flow through condenser.

* * *

Metal	Pent. Ins. per year
Mild Steel	0.0115
Monel	0.0015
Nickel	0.0018 pitted
70/30 Cu-Ni	0.0031
Admiralty	0.0029
18-8 Stainless	Deeply pitted
Cast Iron	0.0096
Ni-Resist Cast Iron	0.0025

Note: Monel linings in lower parts of condensers have given good service. Steel and 18-8 destroyed in the same locations.

Table V.

Product—**Caustic** (from Mercaptan removal unit. Sodium sulfide, phenolates and Mercaptans.)
Temperature—225° F.
Location of Spool—Top of Reboiler.
Time—131 days.
Agitation—Due to flow in column.

* * *

Metal	Pent. Ins. per yr.	
Mild Steel	0.020	pitted 0.012" max.
Monel	0.0014	uniform
Nickel	0.0240	
Inconel, less than	0.0001	uniform
70/30 Cu-Ni	0.0250	pitted 0.003" max.
5% Ni Steel	0.0038	" 0.002" max.
3% Ni Steel	0.0026	" 0.002" max.

Note: Monel tubes widely used in reboiler heater.

Table VI.

Product—Straight Run Gasoline—Michigan crude (HCl present).
Temperature—200° F. (approximate).
Location of Spool—Top Tray in Reflux.
Time—60 days—unless otherwise noted.

(*Continued on page 62*)

Well Depths: Stevens wells 7700 to 7850 feet. Rio Bravo and Vedder zone wells all about 11,500 feet deep.
Number of Producing Wells, 1941: 60, Potential 63.

Average Well Size: Greeley zone wells: Maximum efficient rate about 88 bbls. per day. Zone has gone bad rapidly.

Rio Bravo and Vedder zone wells: Maximum efficient rate about 193 bbls. per day.

Gravity of Oil: Stevens sand 34° to 38° A.P.I.

Rio Bravo and Vedder zones 33° to 39° A.P.I.

Method of Production: Flowing from Rio Bravo and Vedder. Gas lift and pumping from Greeley zone. Fair amount of commercial gas.

Bbls. of Oil Produced in 1941: 2,472,030.

Total Field Production to End of 1941: 6,443,990 bbls.

Proved Acreage at end of 1941: 1820 Acres.

Total Cumulative Production per Acre: 3,540 bbls.

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(20) HELM AREA

(Discovered in 1941)

Location: Sec. 27, 28, 34, T. 16 S., R. 17 E., M.D. B&M., Fresno County.

Topography: Flat.

Type of Oil Accumulation: Anticlinal with other undertermined complicating characteristics.

Geological Horizons Productive: Big Blue—Middle and Lower Miocene and Eocene. Marine fingers in continental deposits.

Thickness of Oil Sands: Several thin streaks totaling to about 50 feet as a maximum.

Well Depths: 7300 feet to 8100 feet.

Number of Producing Wells: 3 (April 1942).

Average Well Size: 1 distillate well with 10,000 M.c.f. gas. 2 wells made about 300 bbls. per day each initially, with high gas oil ratios.

Gravity: 35° to 60° A.P.I.

Method of Production: Flowing.

Productive Acreage: Unknown.

(21) JACALITOS HILLS

(Discovered in 1941)

Location: Sec. 26, T. 21 S., R. 25 E., M.D. B&M., Fresno County.

Topography: Steep hills.

Type of Oil Accumulation: Anticlinal with stratigraphical trap. Sand pinches out to S.W. Axis of anticline is N.W. to S.E.

Geological Horizon Productive: Temblor—Middle Miocene. Marine deposits.

Thickness of Oil Sands: 10 to 35 feet.

Well Depths: 3600 to 3800 feet.

Number of Producing Wells: 4 (April, 1942).

Average Well Size: Initial about 100 to 200 bbls. per day.

Gravity: 39°-40° A.P.I.

Method of Production: 3 flowing, 1 pumping.

Productive Acreage: Unknown.

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(22) KERN FRONT OIL FIELD

(Discovered in 1912)

Location: About 7 miles N.W. of Bakersfield. Townships: 28/27, Sec. 2, 10, 11, 14, 15, 16, and 21-27 incl.

Topography: Rolling hills.

Type of Oil Accumulation: Several overlapping homoclinal zones pinching out up structure to the E.N.E. with the deepest zone lying farthest to the S.W. A fault running about N. & S. limits production on the E. side of the field.

Geological Horizons Productive: Wonder, Lehnhardt, and Tegeler Zones (descending order) ranging from Kern River (terrestrial through Etchegoin (marine) to the Etchegoin-Chanac contact zone (Tegeler) all of Pliocene age.

Thickness of Oil Sands: Generally 150 to 400 feet of zone open, though some wells run as low as 75 feet. Formation probably consists of about 50% sand on the average.

Well Depths: 1400 to 2700 feet (Northeast to Southwest).

Number of Producing Wells, 1941: 429. Potential 465.

Average Well Size: 16 bbls. per day. Cut 73.8% water.

Gravity of Oil: 12° to 15.2° A.P.I.

Method of Production: Wells completed as pumpers. No commercial gas production.

Bbls. of Oil Produced in 1941: 2,133,776.

Total Field Production to End of 1941: 47,719,784 bbls.

Proved Acreage at End of 1941: 3670 acres.

Total Cumulative Production per Acre: 13,000 bbls.

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(23) KERN RIVER OIL FIELD

(Discovered in 1899)

Location: 4 miles N.E. of Bakersfield. Townships: 28/27, Sec. 13, 25, and 36. 28/28, Sec. 19, 20, 21, and 28-34 incl. 29/28, Sec. 2-6 incl. and 8-11 incl.

Topography: Rolling hills and river flats.

Type of Oil Accumulations: Homoclinal accumulation dipping to West. Oil is accumulated in sands which pinch out toward the East. Faulting plays only a minor part in the accumulation.

Geological Horizons Productive: Kern River Series (Continental deposits) Pliocene and possibly Pleistocene.

Thickness of Oil Sands: 100 to 600 feet of formation open. Probably about 65% sand on the average.

Well Depths: 200 feet at East edge to 1200 feet at West edge.

Number of Producing Wells, 1941: 1662. Potential 2256.

Average Well Size: 3.9 bbls. per day. Cut 95% fresh water.

Gravity of Oil: 12° to 14° A.P.I.

Method of Production: Wells completed as pumpers. No commercial gas production.

Bbls. of Oil Produced in 1941: 1,772,989.

Total Production to End of 1941: 275,683,049 bbls.

Proved Acreage at End of 1941: 6810 Acres.

Total Cumulative Production per Acre: 40,480 bbls.

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(24) KETTLEMAN HILLS (Middle Dome) OIL FIELD

(Discovered in 1932)

Location: Kings County. Includes portion of Sections 19, 20, 29, 30, 31

and 32. Located about 3 miles Southeast of the South end of the North Dome.

Topography: Hilly.

Type of Oil Accumulations: Anticlinal.

Geological Horizons Productive: Temblor-Middle Miocene.

Thickness of Oil Sands: 0 to 140 feet.

Well Depths: From 7790 feet to 7960 feet.

Number of Producing Wells, 1941: 3 potential producers.

Average Well Size: 595 B/D initial potential.

Gravity: 58.5°.

Gas: High gas oil ratios.

Method of Production: Flowing.

Bbls. of Oil Produced in 1941: None.

Total Production to End of 1941: 548,562 bbl.

Proved Acreage at End of 1940: 150 acres.

Total Cumulative Production per Acre: 3,657 bbl.

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(25) KETTLEMAN HILLS (North Dome) OIL FIELD

(Discovered in 1928)

Location: Fresno and Kings Counties. Extends from Sec. 13, 21/16 to Sec. 1, 23/18 M.D. B&M. Field averages about 2 miles wide. North end is about 10 miles Southeast of Coalinga.

Topography: Steep hills.

Type of Oil Accumulations: Anticlinal.

Geological Horizons Productive: Temblor-Middle Miocene and Avenal-Eocene.

Thickness of Oil Sands: Temblor oil zone 1300 ft. to 1500 ft. thick. Eocene oil zone 350 ft. to 450 ft. thick.

Well Depths: From 7035 ft. to 8931 ft. in Temblor. From 9850 ft. to 11,175 ft. in Avenal. (McAdams sand).

Number of Producing Wells, 1941: 324 potential, 275 actual.

Average Well Size: Average potential about 680 B/D. Producing about 125 B/D.

Gravity: 32° to 61.7° A.P.I. Average cut—26.1% water.

Gas: Low to high gas oil ratios.

Method of Production: Flowing and gas lift.

Bbls. of Oil Produced in 1941: 13,956,185.

Total Production to End of 1941: 252,522,833 bbls.

Proved Acreage at End of 1941: 12,690 acres.

Total Cumulative Production per Acre: 19,890 bbls.

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(26) LOST HILLS OIL FIELD

(Discovered in 1910)

Location: About 36 miles N.N.W. of Taft on the Paso Robles highway. Townships: 26/20, 26/21 and 27/21.

Separate Areas: Main Field: Township 26/20, Sec. 13 and 24. Township 26/21, Sec. 18, 19, 29, 30, 32, and 33. Township 27/21, Sec. 4, 5, and 9.

North Extension: Township 26/20, Sec. 2, 3, 11, and possibly 12.

Topography: Low ridge and flat lands.

Type of Oil Accumulation: Main Field: Anticlinal accumulations. Axis runs N.W. and S.E. and plunges rapidly to S.E.

North Extension: Monoclinal accumulation on Northeast flank of anticline in four overlying zones of irregular extent and variable productivity.

Geological Horizons Productive: Main Field: Etchegoin-Pliocene, and Santa Margarita (or Reef Ridge)-Upper Miocene. North Extension: Etchegoin only.

Thickness of Oil Sands: 10 to 600 feet.

Well Depths: 500 feet at North End of Main Area to 2400 feet at Southeast end. North Extension: 1130 to 1910 feet.

Number of Producing Wells, 1941: 318. Potential. 409.

Average Well Size: 11.8 bbls. per day. Cut 81.8% water.

Gravity of Oil: 10° to 38°. Some commercial gas produced.

Method of Production: Pumping.

Bbls. Oil Produced in 1941: 1,269,597.

Total Field Production to End of 1941: 51,322,489 bbls.

Proved Acreage at End of 1941: 2136 acres.

Cumulative Production per Acre to end of 1941: 24,020 bbls.

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(27) MARYSVILLE BUTTES (Sutter Buttes) GAS FIELD

(Discovered in 1933)

Location: Sutter County: South side of Buttes only. 4 miles W. of Sutter City. Sec. 1, 2 and 11, T. 15 N., R. 1 E., and Sec. 35, T. 16 N., R. 1 E., M.D. B&M.

Topography: Rugged foothills.

Type of Gas Accumulations: In upturned edges of sands lying on South flank of an igneous intrusive.

Geological Horizons Productive: Cretaceous sands. Extrusive volcanics overly Eocene to the surface in much of area.

Thickness of Gas Zones: Numerous disconnected zones total about 87 ft. of gas sands.

Well Depths: 2727 ft. to 5855 ft.

Number of Producing Wells, 1941: 4 actual, 5 potential.

Gas: About 1015 B.t.u. per cu. ft. Condensate accompanies gas.

Gas Produced in 1941: 1,497,894 M.c.f.

Total Production to End of 1941: About 4,087,878 M.c.f.

Proved Acreage at End of 1941: 320. May extend over 10,000 acres in numerous productive areas.

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(28) McDONALD ISLAND GAS FIELD

(Discovered in 1936)

Location: San Joaquin County: 9 miles West of Stockton on McDonald and Roberts Islands. Not sectionized.

Topography: Flat land reclaimed from San Joaquin River. Actually 5 to 10 feet below sea level. Protected by dikes. Derricks on stilts.

Type of Gas Accumulations: Elongated dome.

Geological Horizons Productive: Eocene sands.

Thickness of Gas Sands: 8 to 33 feet. Probably averages about 25 feet.

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Well Depths: About 5300 feet.

Number of Producing Wells, 1941: 7 potential, 5 actual.

Average Well Size: Initial well made 26 million cubic feet per day on test.

Gas: Dry gas, about 965 B.t.u. per cu. ft. Initial pressure 2086 lb. per sq. in.

Gas Produced in 1941: 9,540,643 M.c.f.

Total Production to End of 1941: About 35,569,998 M.c.f.

Proved Acreage at End of 1941: Estimated 1060 acres or more.

---

(29) McKITTRICK-TEMBLOR-CYMRIC OIL FIELDS

(Discovered in 1898)

Location: McKittrick Field: Just West of town of McKittrick. Township 30/22, Sec. 6, 7, 8, 18, 19, 20, 28, and 29. Township 30/21, Sec. 11, 12, 13, and 14. Township 29/22, Sec. 32.

Temblor Field: 10 miles W.N.W. of McKittrick. Township 29/20, Sec. 36.

Cymric Field: 10 miles N.W. of McKittrick. Township 29/21. Sec. 26.

Topography: Hilly sagebrush country in general although part of the McKittrick Field and the Cymric Field are quite flat.

Type of Oil Accumulation:

McKittrick Field: Homoclinal accumulation against N.E. side of overthrust fault in which Miocene formations thrown over Pliocene formations. Fault runs about N. W. and S.E. through center of Sec. 13/30/21, and S. ¼ cor. Sec. 20/30/22. East side down thrown.

Temblor Field: South flank of small anticline.

Cymric Field: Two small closely spaced anticlines.

Franco-Western Area of McKittrick Field (Sec. 7 and 8, 30/22): Anticlinal. Axis of Anticline N.W. and S.E.

Geological Horizons Productive: McKittrick main area: San Joaquin clays—Pleistocene and Pliocene, and Etchegoin-Pliocene. Franco-Western Area: Contact Zone (Pliocene-Santa Margarita contact). Temblor Field: Temblor - Middle Miocene. Cymric Field: Tulare-Pleistocene.

Thickness of Oil Sands: 10 to 550 feet.

Well Depths: McKittrick main area: 300 to 1200 feet. Franco-Western: 2160 to 2515 feet. Temblor Field: Average 300 feet. Cymric Field: Average about 1150 feet.

Number of Producing Wells All Areas, 1941: 221. Potential: 320.

Average Well Size (combined areas), 1941: 20.4 bbl. per well per day. Water cut 82%.

Gravity of Oil: Main Area: 12° to 20.5°. Franco-Western: 12.3° to 18.4°. Temblor: 15°. Cymric: 12.5° A.P.I.

Method of Production: Pumping.

Bbls. of Oil Produced in 1941: 1,412,078.

Total Field Production to End of 1941: 92,232,604 bbls.

Proved Acreage at End of 1941: 1149.

Total Cumulative Production per Acre: 80,300 bbls.

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(30) MIDWAY SUNSET OIL FIELD

(Discovered in 1900)

Location: Covers huge area. Extends from 3 miles S. and 5 miles E. of Maricopa almost to McKittrick, in fact several areas of the Midway-Sunset Field (as grouped by the State Division of Oil and Gas) are geologically really part of the McKittrick Oil Field. The Midway-Sunset Field is about 7 miles wide in the vicinity of Taft. The higher foothills of the Coast Range Mountains generally mark the West limit of the Field.

Separate Areas: There are so many areas having individual geological conditions that no attempt will be made to describe all of them.

Topography: Varies from steep hills to flat lands all covered with sagebrush, typical desert conditions.

Type of Oil Accumulation: Largest area of field has homoclinal accumulations of oil in one to three overlapping zones which have a general dip to the Northeast. Production is limited to the Southwest by pinching out of zones as underlying Brown Shale—Maricopa Shale—Miocene outcrops in the foothills of the Coast Ranges. Within the limits of the Field are many anticlinal accumulations. These anticlines generally extend outward from the main homoclinal flank though in certain areas there are anticlines in the Brown Shale parallel and near the outcrop which have N.W. and S.E. axes. In certain areas there are accumulations of oil in truncated lenses of the Brown shale which have been sealed by the overlying Pliocene formations. Faulting plays only a very minor part in the accumulations of oil in the Midway-Sunset field as a whole. Its chief effect is at the Southeast end of the Buena Vista Hills where oil in the Scalez and Sub Bittium (or Sub Mulinia) zones has accumulated Southeast of a series of faults running approximately N.E. and S.W. In some cases oil is being produced from fractured Brown shale zones rather than from true oil sands.

Geological Horizons Productive: In the Buena Vista Hills commercial gas production is available from the upper portion of the San Joaquin sands and clays of lower Pleistocene Age. There is probably no oil production from the Pleistocene. Oil production comes from the San Joaquin Clays (sands in lower portion) Pliocene, Etchegoin—Pliocene, Santa Margarita—Uppermost Miocene, and from the Brown Shale—Maricopa Shale—Monterey—Upper Miocene. No Temblor—Middle Miocene or Vaqueros—Lower Miocene production has yet been developed.

Thickness of Oil Sands: Vary from almost nothing to several hundred feet.

Well Depths: 600 to 5000 feet. (Many wells have been drilled deeper but have not secured production).

Number of Producing Wells, 1941: 2745. Potential: 3,687.

Average Well Size: 20.2 bbls. per day. Cut 59% water.

Gravity of Oil: 10° to 28° A.P.I.

Gas: Dry gas zones in Buena Vista Hills overlie oil horizons. Much gas has been produced with

the oil from the oil zones in this area. Much gas stored at times in Buena Vista Hills. Buena Vista Hills portion of Midway-Sunset Oil Field is the only large gas producing area.

Method of Production: Many wells flowed in early days. Almost all wells are now pumpers.

Bbls of Oil Produced in 1941: 17,511,746.

Total Field Production to End of 1941: 910,083,946 bbls.

Proved Acreage at End of 1941: 34,628 acres.

Total Cumulative Production per Acre: 26,290 bbls.

Additional Data Regarding Midway-Sunset Field:—

Anticlinal Accumulations of Oil and Gas: Buena Vista Hills: Consists of two anticlines, end to end, namely United Anticline and Honolulu Anticline. Dry gas in Pleistocene. Oil in Pliocene and Santa Margarita—Uppermost Miocene.

No production obtained in test below Santa Margarita.

Globe Anticline: Oil in Pliocene.

Spellacy Anticline: Oil in Pliocene.

35 Anticline: Oil in Pliocene. Some wells near S.E. end obtain production from lenses in Brown (Maricopa) Shale—Miocene.

Republic Area: Oil from sand lense in Brown Shale.

Williams Area: Oil from sand lense in Brown Shale.

Hovey Hills (Evans) Area: Same.

Truncated Lenses of Sand in Brown Shale—Miocene:

Lakeview Area.

Gibson Area.

Hoyt Area.

Signal Area.

Homoclinal Accumulations: Most of the production extending from the hills valleyward is of this type.

---

(31) MOUNT POSO OIL FIELD

(Discovered 1927)

Location: 12 miles N.N.E. of Bakersfield. Townships 26/27, 26/28, 27/27, 27/28.

Separate Areas:

Main Area: Tp. 27/28, Sec. 4, 5, 8, 9, 10, 15, 16, 21, 22, 27 and 28.

Vanguard Area: Tp. 27/28, Sec. 28, 33 and 34.

Chevalier Area: Tp. 27/28, Sec. 3.

Dorsey Area: Tp. 27/28. Sec 26 and 35.

Dominion Area: Tp. 26/28, Sec. 20, 21 and 28.

Ring Area: Tp. 26/28, Sec. 29 and 32.

Recovery Area: Tp. 26/28, Sec. 33 and 34.

Topography: Steep hills.

Type of Oil Accumulations: Homoclinal accumulations on West side of intersecting faults which run in North to Northwest direction.

Geological Horizons Productive: Upper Vedder zone (Miocene- Vaqueros) in all areas. Lower Vedder in limited portion of Main Area only.

Thickness of Oil Sands: 14 to 240 feet. Upper Vedder sand 80 to 100 feet thick. Not all produced because zone plunges below water table at west side of the various areas. Amount of formation that can be produced depends upon thickness of sands above a relatively flat water table.

Well Depths: 1450 to 2000 feet, average about 1800 feet.

Number of Producing Wells, 1941: 323. Potential: 396.

Average Well Size: 53.9 bbls. per day. Cut 77.4% water.

Gravity of Oil: 14° to 17° A.P.I. Negligible amount of gas produced.

Method of Production: Wells completed as pumpers.

Bbls. of Oil Produced in 1941: 4,102,032.

Total Field Production to End of 1941: 54,967,262 bbls.

Proved Acreage at End of 1941: 1977 acres.

Total Cumulative Production per Acre: 27,800 bbls.

---

(32) MOUNTAIN VIEW OIL FIELD

(Discovered 1930)

(Not actively developed until 1933)

Location: 6 miles S.E. of Bakersfield. Townships: 30/28, 30/29 and 31/29.

Separate Areas:

Main Area (North): Township 30/28, Sec. 13, 14, 23, and 24. Township 30/29, Sec. 18 and 19.

Main Area (South): Township 30/28, Sec. 24 and 25. Township 30/29, Sec. 19, 29, 30, 32, and 33. Township 31/29, Sec. 4, 5, and 9.

Discovery Area: Township 30/29, Sec. 29.

Derby Area: Township 30/29, Sec. 33. Township 31/29, Sec. 4.

Arvin Area: Township 31/29, Sec. 9, 15, and 16.

Isolated Areas: 1 well near center Sec. 26, 2 wells N.E. 1/4 Sec. 27, 31/29.

Topography: Flat lands partially developed in vineyards.

Type of Oil Accumulations: Main Area (North): Homoclinal accumulations on South side of fault running about W.N.W. through the center of S.W. 1/4 Sec. 14 and the S. E. cor. of Sec. 18. Main Area (South): Homoclinal accumulations on S.W. side of fault which runs about N.W. through W. 1/4 cor. Sec. 29 and E. 1/4 cor. Sec. 32. Fault swings westerly at North end and southerly at South end.

Discovery Area: Minor accumulation on W. side of fault running N. to N.W.

Derby Area: Lenticular thin sands of limited areal extent possibly cut off by fault on E. side.

Arvin Area: Accumulation against fault on East side, cross fault at North end of area.

Geologic Horizons Productive: Chanac (terrestrial) — Pliocene, Transition Zone (Chanac-Santa Margarita) Santa Margarita (marine)—Upper Miocene. Chanac production extends farther East than the Santa Margarita productive limits.

Thickness of Oil Sands: 150 to 500 feet of formation open. Averages 50 to 60% sand.

Well Depths: 4200 to 6300 feet.

Number of Producing Wells, 1941: 168. Potential, 183.

Average Well Size: 37.2 bbls. per day. Cut about 42.4% water.

Gravity of Oil: 22° to 32° A.P.I. Field used to produce much commercial gas. Production of gas has dropped rapidly.

Method of Production: Most of wells in field are now pumping. Gas lift was often used for short time after wells stopped flowing.

Bbls. of Oil Produced in 1941: 2,133,915.

Total Field Production to End of 1941: 40,625,695 bbls.

Proved Acreage at End of 1941: 1593 acres.

Total Cumulative Production per Acre: 25,500 bbls. (Would be less using original acreage.)

---

(33) PALOMA OIL FIELD

(Discovered in 1939)

Location: 15 miles Southwest of Bakersfield. Tp. 31/26 and 32/26 M. D. B&M. Just Southeast of Paloma (Buena Vista Lake) Gas Field.

Topography: Flat, sagebrush and farming land.

Type of Oil Accumulations: Anticlinal. Axis N.W.-S.E. Sands get tight to Southwest of axis, thus limiting productive area.

Geological Horizons Productive: Stevens sand — Upper Monterey—Miocene.

Thickness of Oil Sands: Various sands through interval of about 400 feet.

Well Depths: 10143 feet to 10722 feet.

Number of Producing Wells, 1941: 1. Potential: 7.

Average Well Size: Potentials 500 to 2500 bbls. per well per day. Wells highly curtailed.

Gravity: 46° to 55° A.P.I.

Gas: Much commercial gas. Distillate field so far. May use cycling operations to maintain pressure and retard retrograde condensation.

Method of Production: Flowing. Shut-in casing pressure about 3500 lb. per sq. in.

Bbls. of Oil Produced in 1941: 56,396.

Total Production to End of 1941: 208,922 bbls.

Proved Acreage at End of 1940: Estimated 1780 acres reasonably expected to be productive.

Total Cumulative Production per Acre: 117 bbls.

(34) PALOMA DRY GAS FIELD

Formerly known as Buena Vista Lake Gas Field

(Discovered in 1934)

Location: 17 miles Southwest of Bakersfield. Just East of Buena Vista Lake. Township 31-26, Sec. 31, and 32. Township 32/26, Sec. 5.

Topography: Flat, sagebrush and farming.

Type of Gas Accumulation: Anticlinial—elongated dome. Three separate zones of different depths. Edge waters retain high pressure on gas. Upper zone exhausted.

Geological Horizons Productive: San Joaquin Clays (and sand)—Pleistocene and Pliocene.

Thickness of Gas Sands: 20 to 144 feet of zone open, though sand is only 5 to 25 feet thick.

Well Depths: 4217 to 5302 feet.

Number of Producing Wells, 1941: 5 potential.

Gas: 1000 B.t.u.

Initial Shut-in Pressures: 1st Zone 1680 lb./sq. in.; 2nd Zone 1593 lb./sq. in; 3rd Zone 1992 lb./sq. in. (error in gauge.)

Gas Produced in 1941: 197,332 M.c.f.

Gas Production to End of 1941: 3,489,284 M.c.f.

Proved Acreage at End of 1941: 766.

---

(35) POSO CREEK OIL FIELD

(Separate Designation 1934)

(Not actively developed until 1934)

Location: 10 miles N.E. of Bakersfield. Townships: 27/27 and 28-27.

Separate Areas:

Premier: Tp. 27/27, Sec. 29 and 32. Tp. 28/27, Sec. 4, 5, 8, 9, 16, and 17.

McVan: Tp. 27/27, Sec. 10, 11, 14, 15, and 23.

Agey: Tp. 27/27, Sec. 28.

Topography: Rolling hills except steep hills in McVan Area.

Type of Oil Accumulations: Homclinal accumulations on West side of faults which run in North to Northwest direction.

Geological Horizons Productive: Contact Zone (Etchegoin - Chanac contact)—Pliocene. In South part of Main Area production extends well into Chanac.

Thickness of Oil Sands: 40 to 240 feet of formation open. Probably not over 35% sand as an average.

Well Depths: 1200 feet in McVan Area to 2900 feet in S.W. part of Premier Area.

Number of Producing Wells, 1941: 73. Potential: 85.

Average Well Size: 23 bbls. per day. Cut 71% water.

Gravity of Oil: 12° to 15° A.P.I. No commercial gas production.

Method of Production: Wells completed as pumpers.

Bbls. of Oil Produced in 1941: 467,039.

Total Field Production to End of 1941: 4,112,500 bbls.

Proved Acreage at End of 1941: 922 acres.

Total Cumulative Production per Acre: 4,460 bbls.

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(36) POTRERO HILLS GAS AREA

(Discovered in 1938)

Location: Solano County: 6 miles S.E. of Suisun—Fairfield. Sec. 10, T. 4N., R. 1 W., M.D.B.&M.

Topography: Hilly.

Type of Gas Accumulation: Faulted dome.

Geological Horizons Productive: Cretaceous.

Thickness of Gas Sands: 10 feet.

Well Depths. 3265 feet.

Number of Producing Wells 1941: 1 potential.

Gas: 941 B.t.u.

Gas Produced in 1941: None.

Total Production to End of 1941: None commercially.

Proved Acreage at End of 1941: Estimated 40 acres or more.

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(37) RAISIN CITY OIL FIELD

(Discovered in June 1941)

Location: 7 miles West of Raisin City. Sec. 13, T. 15 S., R. 17 E. and Sec. 18 and 19, T. 15 S., R. 18 E., M.D. B.&M.

Topography: Flat grazing land.

Type of Oil Accumulations: Anticline or nose. Not yet determined which one.

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SPECIFICATIONS

Unit	TC-23	TC-23	TC-33H	TC-33H
Set up for maximum stroke of . . (inches)	54	64-½	64	74
Polished-Rod Capacity (A.P.I. Rating) . . . . . (pounds)	17,400	16,000	21,000	19,500
Peak-Torque Capacity at 20 s.p.m. (A.P.I.) . . . . . (inch-lbs.)	115,000	115,000	160,000	160,000
Overall Gear Ratio	32.26:1	32.26:1	31.5:1	31.5:1

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Geological Horizons Productive: Continental beds of probable Miocene age.

Thickness of Oil Sands: About 15 feet productive, underlying 15 to 18 feet of gas sand with impervious body between.

Well Depths: 5044 to 5266 feet.

Number of Producing Wells, 1941: 4 actual and potential.

Average Well Size: Probably good for 100 to 1500 bbls. per well per day.

Gravity: 20° to 36° A.P.I.

Gas: Good supply of commercial gas.

Method of Production: Flowing.

Bbls. of Oil Produced in 1941: 62,716 bbls.

Total Production to End of 1941: 62,716 bbl.

Proved Acreage at End of 1941: 110 acres or more.

Total Cumulative Production per Acre: 570 bbls.

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(38) RIO BRAVO OIL FIELD

(Discovered in 1937)

Location: 3 miles S.S.E. of Shafter and 15 miles W.N.W. of Bakersfield. Extends from N.W. 1/2 of Sec. 28/28/25 to N.W. 1/4 Sec. 1/29/25. About 1 mile wide.

Topgraphy: Flat lands, farms and sagebrush.

Type of Oil Accumulation: Anticlinal.

Geological Horizons Productive: Rio Bravo sand and Vedder sand—both Vaqueros — Lower Miocene. Rio Bravo sand is productive beyond limits of Vedder sand.

Thickness of Oil Sands: Wells have taken in from 20 to 225 feet of sand. Average 170 feet. About 60 to 80% sand.

Well Depths: 11,450 to 11,550.

Number of Producing Wells, 1941: 92. Potential: 93.

Average Well Size: Wells are completed with potentials from 1000 to 6000 bbls. per day and are then heavily curtailed. Cut averages about 2% water.

Gravity of Oil: 34° to 40° A.P.I. Wells produce much commercial gas.

Method of Production: Flowing.

Bbls. of Oil Produced in 1941: 4,537,211.

Total Production to End of 1941: 12,726,066 bbls.

Proved Acreage at End of 1941: 2040 acres.

Total Cumulative Production per Acre: 6237 bbls.

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(39) RIO VISTA GAS FIELD

(Discovered in 1936)

Location: Solano, Sacramento and Contra Costa Counties. Surrounds and includes town of Rio Vista. Sec. 4, 5, 6, 7, T. 3N., R. 3E., M.D. B&M. and S.W. portion of T. 4N, R. 3E.

Not Sectionized on Rancho Los Ulpinos.

Topography: Flat, swampy, but with N.W. portion in low hills.

Type of Gas Accumulation: Faulted dome.

Geological Horizons Productive: Eocene sands.

Thickness of Gas Sands: 35 ft. to 600 ft. of zone running 10% to 60% sand.

Well Depths: 3883 ft. to 4600 ft.

Number of Producing Wells, 1941: 39 potential, 25 actual.

Gas: Large reserves of commercial gas. Light spray of gasoline caught in traps.

Gas produced in 1941: 15,810,553 M.c.f.

Total Production to End of 1941: About 35,979,000 M.c.f.

Proved Acreage at End of 1941: Estimated 17,190 acres.

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(40) RIVERDALE AREA

(Discovered in 1941)

Location: Sec. 26, T. 17 S., R. 18 W., M.D. B&M. Fresno County.

Topography: Flat.

Type of Oil Accumulation: Anticlinal.

Geological Horizons Productive: Big Blue — Middle Miocene. Continental beds.

Thickness of Oil Sands: Not over 50 feet of produceable streaks of oil sands. Gas sands and water sands closely associated.

Well Depths: 6700 to 6900 feet.

Number of Producing Wells: 3 wells (April 1942).

Average Initial Production: 558 bbls., curtailed.

Gravity: 35° A.P.I. Cut 3% water.

Method of Production: Flowing.

---

(41) ROUND MOUNTAIN OIL FIELD

(Discovered in 1927)

Location: 9 miles N.E. of Bakersfield. Townships 28/28 and 29/28.

Separate Areas:

Main Area: Tp. 28/28, Sec. 12 and 13. Tp. 28/29, Sec. 7, 17, 18, 19, 20, and 29.

Coffee Canyon: Tp. 28/28, Sec. 1, Tp. 28/29, Sec. 6, 7, and 18.

Olcese: Tp. 28/29, Sec. 21.

Eastmont: Tp. 28/29, Sec. 16.

Crestmont: Tp. 28/29, Sec. 8, 16, and 17.

Trico: Tp. 28/29, Sec. 8.

Topography: Steep hills.

Type of Oil Accumulations: Homoclinal accumulations on West side of intersecting faults which run in North to Northwest direction.

Geological Horizons Productive: Upper Vedder zone (Vaqueros-Miocene) except that part South of Jewett cross fault lying about 0.7 mile North of South end of Main Area and the Olcese Area. Jewett zone (bottom part sometimes called Elbe) productive south of Jewett fault and in Olcese Area. Jewett zone overlies Vedder but also of Vaqueros age.

Thickness of Oil Sands: Vedder 40 to 104 feet thick. Jewett Silts and Sands (sands about 30%) 600 feet thick. Amount of zone produced depends upon thickness above relatively flat water table and upon some intermediate waters.

Well Depths: 1250 to 2250 feet. Average about 1800 feet.

Number of Producing Wells, 1941: 226. Potential: 247.

Average Well Size: 44 bbls. per day. Cut 80% fresh water.

Gravity of Oil: Jewett zone: 19° to 21° A.P.I.; Vedder zone: 14° to 18° A.P.I.

Method of Production: Wells completed as pumpers. Negligible amount of gas except in limited area

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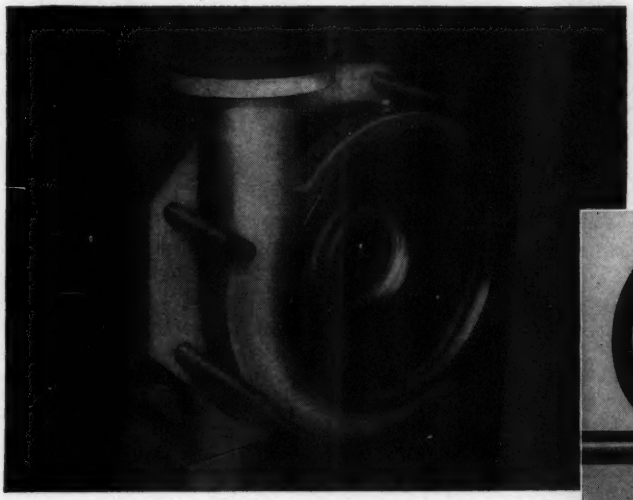

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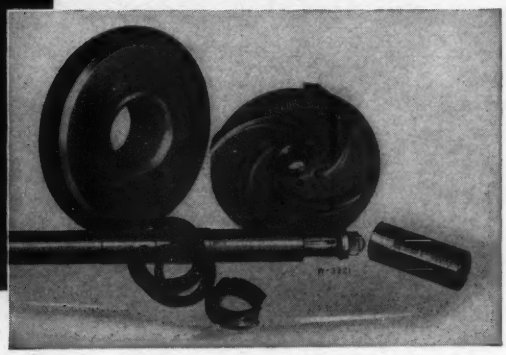

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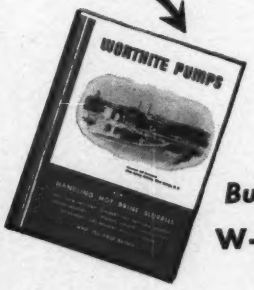

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near fault in Main Area of Field in Sec. 17 and 20, Tp. 28/29.

Bbls. of Oil Produced in 1941: 2,834,822 bbls.

Total Field Production to End of 1941: 31,234,533 bbls.

Proved Acreage at End of 1941: 1562 acres.

Total Cumulative Production per Acre: 20,200 bbls.

---

(42) SEMITROPIC GAS FIELD

(Discovered in 1935)

Location: 30 miles Northwest of Bakersfield and 8 miles West of Wasco. Township 27/22, Sec. 1 and 12; Township 27/23, Sec. 6-9 incl., 14, 15, 16, and 22 to 26 incl.

Topography: Flat sagebrush land.

Type of Gas Accumulation: Anticlinal. Sand zones.

Geological Horizons Productive: Zone under North part of field known as North Mya Zone, that under central portion, Hill Zone, and that under South portion, South Mya Zone. All are of Upper San Joaquin Clays (and sands)—Pleistocene age.

Thickness of Sands: 1 to 10 feet, average about 3 feet.

Well Depths: North and South Mya wells 2300 to 2400 feet. Hill Zone Wells 2950 to 3200 feet.

Number of Producing Wells, 1941: 17.

Gas: 980 Btu.

Initial Shut-in Pressures: N. Mya 1014 lb./sq. in.; S. Mya 1004 lb./sq. in.; Hill Zone 1352 lb./sq. in.

Gas Produced in 1941; 738,235 M.c.f.

Gas Production to End of 1941: 4,393,103 M.c.f.

Proved Acreage at End of 1941: About 2900 acres.

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(43) STRAND OIL FIELD

(Discovered in 1939)

Location: 11 miles W.S.W. of Bakersfield and just N.E. of the Canal Field. In Sec. 12/30/25 and 7/30/26.

Topography: Flat sagebrush land.

Type of Oil Accumulations: Dome

Geological Horizons Productive: Stevens Sand—Monterey—Miocene. Vedder zone tested nonproductive.

Thickness of Oil Sands: About 114 feet from 3 separate zones.

Well Depths: 8320 feet to 8750 feet. Tested to 14,051 feet.

Number of Producing Wells, 1941: 14.

Average Well Size: Top allotment wells. Heavily curtailed.

Gravity: 34° to 36° A.P.I.

Gas: Some commercial gas.

Method of Production: Flowing. Some wells will have to go on pump soon.

Bbl. of Oil Produced in 1941: 547,256.

Total Production to End of 1941: 1,215,356 bbls.

Proved Acreage at End of 1941: 200 acres.

Total Cumulative Production per Acre: 6077 bbls.

---

(44) TEN SECTION OIL FIELD

(Discovered in 1936)

Location: 12 miles S.W. of Bakersfield. Township 30/25, Sec. 24 and 25. Township 30/26, Sec. 19-21, 28-32 incl.

Topography: Flat land covered with sagebrush and mesquite in places.

Type of Oil Accumulation: Anticlinal, or elongated dome.

Geological Horizons Productive: Stevens Zone-Upper Monterey-Upper Miocene. No attempt has yet been made to secure production from the Rio Bravo Sand-Vedder- Vaqueros-Lower Miocene. Strand Field, to North, and Canal Field to Northwest, tested unproductive in Vedder.

Thickness of Oil Sands: From top of gas cap to flat water table is about 600 feet. Gas cap is about 200 feet thick on top of the structure. 60 to 300 feet of formation is open to wells, of which about 75% is sand.

Well Depths: All wells about 8200 feet deep on account of flat bottom water table.

Number of Producing Wells, 1941: 99. Potential: 114.

Average Well Size: Wells initially good for 1500 to 3500 bbls. oil per day where well located on structure. Production is heavily curtailed thereafter.

Gravity of Oil: 34° to 38° A.P.I. Cut about 3% water.

Method of Production: Flowing. Large amounts of commercial gas.

Bbls. of Oil Produced in 1941: 5,232,153.

Total Field Production to End of 1941: 15,592,142 bbls.

Proved Acreage at End of 1941: 1920 acres.

Total Cumulative Production per Acre: 8,120 bbls.

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(45) TRACY GAS FIELD

(Discovered in 1935)

Location: San Joaquin County: 1½ miles N.E. of Tracy. Sec. 15, T. 2S., R. 5E., M.D. B&M.

Topography: Flat.

Type of Gas Accumulation: Dome.

Geological Horizons Productive: Cretaceous sands.

Thickness of Gas Zone: 35 feet to 100 feet, alternating sands and shales.

Well Depths: 4025 to 4060 feet.

Number of Producing Wells, 1941: 4 potential, 2 actual.

Initial Shut-in Pressure: About 1620 lb. per sq. in.

Gas: About 935 B.t.u.

Gas Produced in 1941: 533,738 M.c.f.

Total Production to End of 1941: About 9,508,664 M.c.f.

Proved Acreage at End of 1941: Estimated 310 acres or more.

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(46) TRICO GAS FIELD

(Discovered in 1934)

Location: 37 miles Northwest of Bakersfield, extending almost to, and perhaps beyond, the King's County line. Extends from Sec. 18/24/23 to Sec. 1/25/23. About 2 miles wide.

Topography: Flat sagebrush land.

Type of Gas Accumulation: Anticlinal, almost flat.

Geological Horizons Productive: Upper San Joaquin Clays (and sands) productive — Pleistocene. Two zones (1st Mya and 2nd Mya) productive in different places. Widgeon zone produced at south tip of field only. Extent of Widgeon Zone unknown. Widgeon wells are poor.

Thickness of Gas Sands: Average about 18 feet of sand.

Well Depths: 2454 to 3255 feet.

Number of Producing Wells, 1941: 28. Seven produceable in Kern County portion of the field.

Gas: 980 B.t.u.

Initial Shut-in Pressures: 1074 and 1390 lb./sq. in. Higher pressure in Widgeon Zone (deep zone).

Gas Produced in 1941: 2,375,040 M.c.f.

Gas Production to End of 1941: 9,701,942 M.c.f.

Proved Acreage at End of 1941: About 7177 acres. About 85% in Tulare County, 15% in Kern County.

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(47) VERNALIS GAS FIELD
(Discovered in 1941)

Location: San Joaquin and Stanslaus Counties. 14 miles W. of Modesto on Rancho El Pescadero. Ranch not sectionized.

Topography: Flat.

Type of Gas Accumulation: Type of structure as yet unknown.

Geological Horizons Productive: Cretaceous sand.

Thickness of Gas Sands: 11 feet.

Well Depths: 3872 feet and 3870 feet.

Number of Producing Wells, 1941: 2 potential.

Gas: Estimated production rate 10,000 M.c.f. per day on No. 1 well.

Shut-in pressure about 1700 lb. per sq. in.

Two wells flowed only a short time on tests, then shut in.

Proved Acreage at End of 1941: 100 acres with 500 to 1000 acres possible.

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(48) WASCO OIL FIELD
(Discovered in 1938)

Location: 5 miles West of Wasco and 27 miles Northwest of Bakersfield. Township 27/24, Sec. 7, 8, and 17.

Topography: Flat sagebrush country.

Type of Oil Accumulation: Anticlinal or dome.

Geological Horizons Productive: Rio Bravo Sand — Vedder — Vaqueros—Lower Miocene.

Thickness of Oil Zone: About 45 feet.

Well Depths: Deep zone 13,130 13,158. Wells have gone below this depth but have been wet and plugged back. The deepest well in the world, 15,004 feet, was drilled here.

Number of Producing Wells, 1941: 12. One of these wells makes a little oil from fractured shale in Upper Monterey-Miocene. Produces by heads only.

Average Well Size: Wells are completed for as much as 6000 bbls. per day potential and are then heavily curtailed.

Gravity of Oil: 36° to 39° A.P.I. Commercial gas is produced. Cut 3% water.

Method of Production: Flowing.

Bbls. of oil Produced in 1941: 630,848.

Total Field Production to end of 1941: 1,724,153 bbls.

Proved Acreage at End of 1941: 220 acres.

Total Cumulative Production per Acre: 7,840 bbls.

---

(49) WHEELER RIDGE OIL FIELD
(Discovered in 1922)

Location: 33 miles South of Bakersfield and 21 miles East of Maricopa. Sec. 27 and 28, T. 11 N., R. 20 W., S. B. B&M.

Topography: Steep hills.

Type of Oil Accumulations: Anticlinal. Axis of anticline almost East and West.

Geological Horizons Productive: Etchegoin — Pliocene and Santa Margarita—Uppermost Miocene. Some oil obtained from Vaqueros in deep test.

Thickness of Oil Sands: Numerous stringers of sand extending from the tar sands at 1500 feet to 4150 feet or more.

Well Depths: 2100 to 4100 feet.

Number of Producing Wells, 1941: 34.

Average Well Size: 8.5 bbls. per day. Cut 20% water.

Gravity: 22° to 30° A.P.I. Average is about 23°.

Gas: None commercial.

Method of Production: Pumping.

Bbls. of Oil Produced in 1941: 104,005.

Total Production to End of 1941: 3,944,841 bbls.

Proved Acreage at End of 1941: 240 acres.

Total Cumulative Production per Acre: 16,440 bbls.

---

(50) WILLOWS GAS AREA
(Discovered in 1938)

Location: Glenn County: 6 miles N.E. of Willows. Sec. 18, T. 20 N., R. 2W., M.D. B.&M.

Topography: Flat marshy land.

Type of Gas Accumulation: Anticline.

Geological Horizons Productive: Cretaceous sands.

Thickness of Gas Sands: 30 feet plus.

Depth to Producing Zone: 2235 feet.

Number of Producing Wells, 1941: 1 well potential, shut-in.

Gas Produced in 1941: None. 1 well shut in.

Total Production to End of 1941: No commercial production.

Proved Acreage at End of 1941: Undetermined.

BEFORE billets can be converted into bullets, tanks, guns, ships, jeeps and other implements of war, the Steel Industry must have scrap metal to convert into billets.

The Steel Industry has the productive capacity to furnish the complete requirements of our War Production Program. It cannot operate to its full capacity, however, due to the acute shortage of scrap which has already been the cause of limiting war production in many lines.

The Petroleum Industry is one of the largest potential sources of scrap in America. As associates of the Steel Industry and of the Petroleum Industry, we ask your complete cooperation in the American Industries Salvage Committee's Drive for scrap.

Scrap will help us win—one pound of scrap helps make two pounds of fighting steel. Old nuts and bolts—discarded machinery—odd lengths of pipe will all help our fighting men achieve their goal of VICTORY.

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Oil Fields of Southern California

By Vernon L. King*

Vernon L. King

Fields Arranged Alphabetically

Los Angeles Basin Oil Fields

Los Angeles Basin enjoys the unique position of having the greatest concentration of large oil fields in the United States. Of the seventy-five top ranking oil fields rated on accumulated production, twenty are in California and eight of these are in Los Angeles Basin. During 1941, California produced about one-seventh of the Nation's oil and half of this came from Los Angeles territory.

The total production of the United States to January 1, 1942, is over twenty-five billion barrels. California has produced somewhat less than six billion, and of this Southern California is credited with two and a half billion barrels of crude. According to estimates of reserves, the United States still has twenty billion barrels to be produced with three and one-half billion to come from California and about one billion from Los Angeles Basin.

Any increase in our reserves will have to come from new discoveries. In a small geological province that has been exploited for forty years, it is becoming more difficult and costly. However, during the past year two operators have made discoveries which add greatly to the geological prospects. Continental Oil Company Turnbull No. 1 discovered a field on the north side of Puente Hills which increases the area favorable for prospecting considerably. The Texas Company in Spencer No. 1 near Fullerton, has demonstrated the possibility of production from a sedimentary trap in the Los Angeles Basin. This "East Texas" type of accumulation exists in Santa Maria and San Joaquin Valley, and may be the geological approach to a series of new discoveries in Southern California.

California Statistics Are Important to War Effort

During 1941 Los Angeles Basin produced one hundred five million barrels of crude or about two hundred ninety thousand barrels per day, which exceeds slightly San Joaquin Valley with its two hundred sixty thousand barrels per day. During these times we often think in items of war resources and make comparisons with our opponents. In the case of Germany and her central European allies (including Rumania) the potential crude is about one hundred fifty thousand barrels per day but the actual is somewhat less, due to war conditions. In addition, slightly more than one hundred thousand barrels per day of synthetic gasoline is manufactured, so the total motor fuel products available to Germany is just about the same as is now being produced in Southern California.

The case of Japan is very different. She produces about ten thousand barrels per day, which is less than the daily output of Rosecrans field. Just how much of the East Indies' one hundred eighty thousand barrels per day, and Burma's twenty-two thousand barrels per day she can produce and ship is only a matter of conjecture, but in all possibility not much will be immediately useful.

Aside from accumulated stocks, it would appear that the Axis powers at present have fuel sources which are equivalent to Southern California production. Should Japan be able to restore the oil fields of the East Indies and Burma, then the Axis would have the equivalent of something less than California's total production.

In passing, no further mention need be made of the importance of California's oil supply. However, because of geography and concentration of industry, our oil development is more vulnerable to attack and fire than similar enterprises in many other states. Thinking in terms of present production and reserves is not enough. We must protect what we have.

Geology

Los Angeles Basin is an embayment filled with Miocene sediments, thirty by sixty miles in extent.

*Vernon L. King graduated from Stanford University in 1916 following which he was employed by Midwest Oil Company in Wyoming until entering military service the following year. At the close of the war Mr. King returned to Los Angeles and resumed his professional career which since has taken him to nearly every important oil producing area in the United States. At various times he has been connected with major companies but for the past twelve years he has engaged in consulting work specializing in California.

He holds membership in the American Institute of Mining & Metallurgical Engineers, American Association of Petroleum Geologists and American Petroleum Institute.

FUEL *for Fury!*

For the kind of fury that is smashing at the Axis forces more effectively each day...that is now in action... everywhere!

Our armed forces have demonstrated the devastating effectiveness of their fury...To keep it effective...to move it faster and farther...that is the responsibility of the oil industry. Tret-O-lite Dehydrating Compounds and Service can better *your* ability to fulfill your part of this responsibility. Call one of our representatives; they are always "on call"...everywhere.

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Oil is Ammunition • Treat it Right

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COMPLETE SERVICE FOR EVERY FIELD

Most of the oil fields of Southern California fall into one of three structural lines: (1) the Northern or Puente fault fields, i.e. Brea-Olinda, Whittier, Montebello, and Los Angeles; (2) the central or elongated anticlinal fields, i.e. Richfield, East and West Coyote, and Santa Fe Springs; (3) Southern or Inglewood fault fields, i.e. Huntington and Seal Beaches, Signal Hill, Dominguez, Athens-Rosecrans, Inglewood and Culver City.

The remaining large fields, Venice-Del Rey, El Segundo, Torrance, and Wilmington, are gentle folds of the composition type, modified by faulting.

Oil occurs in sand layers principally of Lower Pliocene and Upper Miocene age. Considerable dissolved gas acts as the immediate propelling agent for the flowing wells. The presence of several productive zones one hundred feet or more in thickness gives the effect of a number of fields, one on top of the other. Because of this, recovery per acre is high; for example, Signal Hill, with five hundred thousand barrels per acre is actually producing from three to five thousand feet of sand zone.

In spite of the fact that intense drilling has been in progress for years some reserves are still in prospect. Their discovery will probably be associated with one or more of the following:

(1) Deeper development or fault accumulation in old fields;
(2) Structural traps in new area;
(3) Sedimentary traps in deeper parts of the Basin.

In future prospecting along above lines will depend largely on mechanical skill in operations, but this seems assured, as personnel in all departments of development are constantly improving technique.

ALAMITOS FIELD—

Location: East of Long Beach (Los Angeles County)
Discovery date: 1927, by Pet. Securities Co.
Method: Topographic high.

Geology

Type structure: Minor dome with 100 ft. closure on faulted anticline.
Age producing horizon: Repetto-Puente (Plio-Mio).

Name Producing Horizon	Gravity
Bixby Selover Wasem McGrath	16 to 28

Character Reservoir: Sand.

Development

Proven area: 85 acres.
Number wells: effective, 1; ineffective, 0; producing, 38. Total, 39.
Depths: 4635-5810.
Deepest well: Getty No. 12, 7180.

Production

Grouped with Seal Beach.
Avg. daily production during March, 1942: 961 bbls.
Maximum effective rate March, 1942, 1100 bbls.

The field was discovered by drilling on a topographical high after Seal Beach was found productive. Several equally prominent features were subsequently drilled but failed to produce.

ALISO CANYON FIELD—

Location: 6 miles northwest of San Fernando (Los Angeles County).
Discovery date: October, 1938, by Associated Oil Co.
Method: Mapping field geology.

Geology

Type structure: Anticline.
Age producing horizon: Pliocene and Miocene.

Name Producing horizon	Thickness	Avg. Depth	Gravity
Pliocene	200	4800	22
Miocene	400	5400	26
Porter Zone ..	400±	7500	53

Character Reservoir: Sand.

Development

Proven area: 150 acres. The field is being developed.
Number wells: effective, 2; ineffective, 0; producing, 15. Total,17.
Depths: 5300-7850.
Deepest well: 8202, Miocene.

Production

1941: 952,603 bbls.
Total Production to 1942: 1,718,564.
Avg. daily production during March, 1942: 1645 bbls.
Maximum effective rate, March, 1942: 2406 bbls.

BREA-OLINDA-TONNER FIELD—

Location: Eastern Puente Hills, near Los Angeles-Orange County line in eastern Orange County.
Discovery date: 1889, by So. Cal. R. R. Co. Olinda No. 1.
Method: Drilling near seepage.

Geology

Type structure: Monocline against fault.
Age producing horizon: Plio-Repetto, deep zone, Miocene.

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Brea Area	1000	3500-5600	14
Olinda Area	500	700-4500	to
Tonner Area ...	400	700-4100	31
Deep zone	400	5000-5600	

Character reservoir: Sand lenses in Repetto shale.

Development

Proven area: 1900 acres.
Number wells: effective, 12; ineffective, 53; producing, 352. Total, 417.
Depths: 750-5600 ft.
Deepest well: 8021.

Production

1941: 2,050,580 bbls.
Total Production to 1942: 167,893,945 bbls.
Maximum effective rate March, 1942: 11,195 bbls.
Avg. daily production during March, 1942: 8858 bbls.

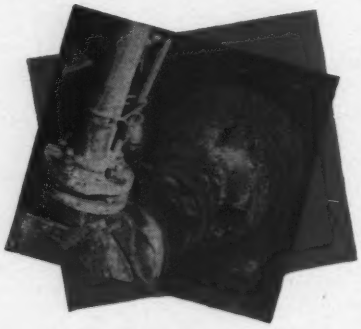
NEED MOTORS?

4 things to do

use standard, open, sleeve-bearing motors whenever possible . .

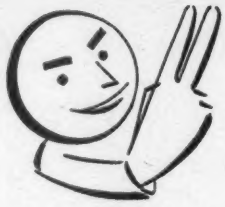
The standard Tri-Clad motor, though classed as an "open" motor, is so well protected that it gives good service on many jobs for which specially protected motors previously were recommended. (See below.)

Sleeve-bearing motors often can be supplied more readily than ball-bearing types because of the present demand for ball bearings on other war equipment. Use ball-bearing motors only on applications where load or mounting conditions definitely require them.



Special end shields and other modifications may result in delay for you and others doing war work.

Consider the use of standard or multi-speed a-c motors in place of d-c wherever this alternative is possible.

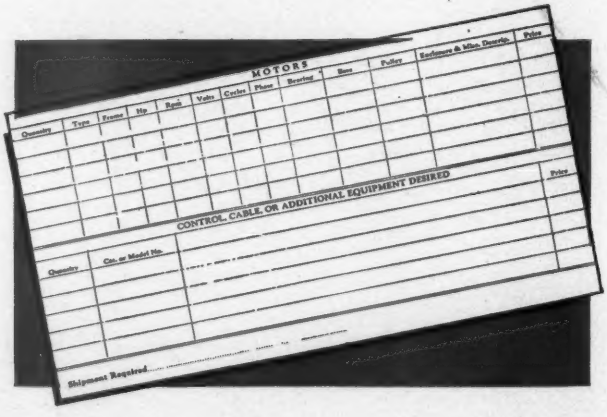


order motors early . . giving complete specifications . .

Place motor orders when you order the machines they are to drive.

If you are planning motor drives for conveyors or other equipment for new plants, place orders as soon as design work indicates the motor requirements.

Avoid delay and "mix-ups" by giving complete specifications as shown in table below, preferably on an order form which your G-E motor representative can supply.



YOUR AID ON THESE 4 POINTS WILL HELP US PRODUCE AND DELIVER MORE MOTORS

YOUR CHOICE OF G-E TRI/CLAD MOTORS WILL GIVE YOU EXTRA PROTECTION AGAINST (1) PHYSICAL DAMAGE, (2) ELECTRICAL BREAKDOWN, (3) OPERATING WEAR.

...for WAR WORK?

...to get them quicker

give complete priority information properly endorsed..

The filling of many motor orders is delayed because of incomplete priority information. If in doubt about details, call your local G-E office.

When placing orders for motors, be sure that complete priority data accompanies *each order* in the form of certificates, endorsements properly signed, etc. The priority is not effective in scheduling shipment until received by your supplier.

Your needs and the war effort are best served by using the proper priority rating as assigned by the War Production Board for the job involved and requesting delivery no earlier than actually required.

Builders of motor-equipped machines for subsequent sale may order their requirements in advance under the Production Requirements Plan.

check with G. E. for delivery from local warehouse stocks..

To meet urgent war needs, a supply of standard Tri-Clad motors is maintained at G-E factories and local G-E warehouses. Perhaps the motor you want, or can use with a few simple changes, is available for immediate shipment.

Your local G-E motor representative can furnish information on motors which may be in stock in the following cities:

Atlanta, Ga.	Los Angeles, Calif.
Boston, Mass.	Milwaukee, Wis.
Buffalo, N. Y.	Minneapolis, Minn.
Charleston, W. Va.	New York, N. Y.
Chicago, Ill.	Oklahoma City, Okla.
Cincinnati, Ohio	Omaha, Neb.
Cleveland, Ohio	Philadelphia, Pa.
Dallas, Texas	Pittsburgh, Pa.
Davenport, Iowa	Portland, Ore.
Denver, Colo.	St. Louis, Mo.
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General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

Specify TRI-CLAD Motors

GENERAL ELECTRIC

Puente Hills field, one mile north of Brea Canyon field, was discovered by W. H. Rowland about 1885. Forty-two wells were drilled from 400 ft. to 2800 ft. in depth and have produced about 610,000 bbls. of 25 A.P.I. gravity oil. This was the first field in the Los Angeles Basin.

Development of the Brea-Olinda followed due to seepage of oil along the Puente fault. One of the most productive areas in California centers about Birch No. 5, Brea Canyon field.

EAST COYOTE FIELD—

Location: Hills NE of Fullerton (Orange County).
Discovery date: May, 1911, by Graham & Loftus, A.W.W. No. 1.
Method: Wildcat on surface structure.

Geology

Type structure: Anticline with two local domes.
Age producing horizon: Repetto-Puente.

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Graham-Loftus (Repetto)	300	3300	18
Mathis (Puente) ..	400-600	4700	20
Stern (Puente) ...	100	6900	26

Character reservoir: Sand.

Development

Proven area: 1080 acres.
Number wells: effective, 1; ineffective, 6; producing, 125. Total, 132.
Depths: 2450-7000.
Deepest well: 9084, Miocene.

Production

1941: 1,379,162 bbls.
Total Production to 1942: 82,476,532 bbls.
Avg. daily production during March, 1942: 4788 bbls.
Maximum effective rate, March, 1942: 6508 bbls.

During the past two years 15 wells have been completed in the field about equally divided between the upper zone in the Carolina St. area and the new Stern Zone. Stern zone development has been confined to the extreme western end of the structure and has added about 200 acres to the proven area.

WEST COYOTE FIELD—

Location: Hills north of Fullerton (Orange County)
Discovery date: 1909, by Murphy Oil Co.
Method: Wildcat on surface anticline.

Geology

Type structure: Domed anticline.
Age producing horizon: Repetto-Puente.

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Murphy	475	3000	24
Ninety-Nine	800	4300	to
Emery	700	5900	33
McNally		6700	

Character reservoir: Sand.

Development

Proven area: 985 acres.
Number wells: effective, 13; ineffective, 47; producing, 102. Total, 162.
Depths: 2800-6200.

Production

1941: 2,070,608 bbls.
Total production to 1942: 86,566,322 bbls.
Avg. daily production during March, 1942: 8577 bbls.
Maximum effective rate, March, 1942: 16,108 bbls.

Field is operated principally by one company. Secondary recovery methods by repressuring are being used. Recovery per well has been high.

DEL VALLE FIELD—

Location: 3 miles west of Castaic (Los Angeles Co.)
Discovery date: October, 1940, by Havenstrite, R. E., Opr.
Method: Anticlinal structure.

Geology

Type structure: Faulted anticline.
Age producing horizon: Upper Modelo-Miocene.

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Havenstrite zone	200	6500	31-34

Character reservoir: Sand.

Development

Proven area: 320 acres. (This field is still in development stage.)
Number wells: effective, 1; ineffective, 0; producing, 15. Total, 16.
Depths: 6200-7000.
Deepest well: 7700 ft., Miocene.

Production

1941: 695,931 bbls.
Total production to 1942: 726,622 bbls.
Avg. daily production during March, 1942, 1109 bbls.
Maximum effective rate, March, 1942: 1700 bbls.

DOMINGUEZ FIELD—

Location: Hill south of Compton (Los Angeles Co.)
Discovery date: Sept., 1923, by Union Oil Co. (Callender 1-A).
Method: Drilling on surface structure.

Geology

Type structure: Dome with minor faults.
Age producing horizon: Repetto-Puente (Plio-Mio).

Name Producing Horizon	Avg. Depth	Gravity
1st to 5th Callender (Pliocene) ..	4100-5400	22-32
6th to 9th Callender (Miocene) ..	5400-8000	25-33

Character reservoir: Sand, total 1900 ft. for all zones.

Development

Proven area: 1054 acres.
Number of wells: effective, 28; ineffective, 6; producing, 273. Total, 307.
Depths: 3850-8200.
Deepest well: 12,120; Union Oil Co.

Production

1941: 8,478,063 bbls.

Total production to 1942: 130,254,291 bbls.

Avg. daily production during Mar., 1942: 17,985 bbls.

Maximum effective rate, March, 1942: 38,725 bbls.

Field has been systematically developed principally by two companies. Repressuring of individual zones is being employed. Area has been extended to the west recently by development of a fault trap accumulation. Casings in eleven oil wells were collapsed or sheared along a fault plane during an earthquake in the fall of 1941.

EL SEGUNDO FIELD—

Location: Minor hills east of El Segundo (Los Angeles County).

Discovery Date: 1935, by Republic Pet. Co.

Method: Magnetometer.

Geology

Type structure: Dome over schist high.

Age producing horizon: Puente-Franciscan (Miocene-Jurassic).

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Conglomerate ...	0-100	6900	22
Schist	0-200	7200+	to 27

Character reservoir: Conglomerate and fractured schist.

Development

Proven area: 930 acres.

Number wells: effective, 1; ineffective, 4; producing, 35. Total, 40.

Depths: 6900-7600.

Deepest well: 8009. Schist.

Production

1941: 521,446 bbls.

Total production to 1942: 10,136,608 bbls.

Avg. daily production during March, 1942, 1212 bbls.

Maximum effective rate, March, 1942: 1355 bbls.

Recovery per acre has been low and wells are generally abandoned when water encroaches.

Playa Del Rey-El Segundo Fields:

The above are known as the schist fields and are restricted to small districts in the western part of the Los Angeles Basin. The oil has accumulated in detrital material eroded from and deposited around old schist mountain tops. In some instances the oil has even permeated what is considered to be fractured zones extending several hundred feet down into the schist. The source of the oil is thought to have originated in the overlying Miocene shales and migrated into the above mentioned schistose material, which happens to be in a higher structural position. These fields are of great interest because of accumulation under peculiar geological conditions.

HUNTINGTON BEACH FIELD—

Location: Coastal area (Orange County).

Discovery Date: 1920, by Standard Oil of Cal., Bolsa Chica No. 1.

Method: Structure determined by geologic mapping.

Geology

Type structure: Old field—Monocline; Tidelands—Anticline.

Age producing horizon: Repetto-Puente (Plio-Miocene).

Name Producing Horizon	Avg. Depth	Gravity
Tar	2200	11-19
Ashton	4000-4800	14-26
Townlot	3800-4500	19
Tideland	4000-5700	23-27

Character reservoir: Medium grained sand bodies; porosity 30 plus, permeability 200-400 M.

Development

Proven area: 2100 acres.

Number wells: effective, 20; ineffective, 46; producing 664. Total 730.

Depths: 2200-5700.

Deepest well: 9054, Miocene. W. E. McCaslin. 1941: 10,692,377 bbls.

Total production to 1942: 301,010,625 bbls.

Avg. daily production during March, 1942: 27,821 bbls.

Maximum effective rate, March, 1942: 39,050 bbls.

A novel feature of this field is the development of a structure under the ocean by slant hole drilling from locations along the shore. Some 97 wells have been bottomed under the ocean 1000 to 3000 feet southwest of the surface location.

INGLEWOOD-BALDWIN HILLS FIELD—

Location: Hills north of Inglewood (Los Angeles County).

Discovery date: 1924, by Standard Oil Co., L. A. Inv. No. 1.

Method: Drlg. on surface structure.

Geology

Type structure: Faulted anticline.

Age producing horizon: Pico-Puente and Topango (Pliocene-Miocene).

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Vickers-Machado	1400	1200	17
Rindge	800	2600	24
Rubel-Moynier ...	800	3400	30
Sentous	200	7200	34

Character reservoir: Thick sand beds without prominent shale bodies.

Development

Proven area: 860 acres.

Number wells: effective, 4; ineffective, 36; producing, 274. Total, 314.

Depths: 1400-8340.

Deepest well: 10,598 ft.

Production

1941: 4,890,688 bbls.

Total Production to 1942: 125,704,085 bbls.

General Heading: BAKER WALL SCRAPER AND BAKER WALL SAMPLER

Unit No. A-14

Subject: A Safe, Economical Solution to Hole Enlarging, Wall Scraping and Wall Sampling Problems

BAKER OIL TOOLS, INC.

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Export Sales Office:
19 Rector Street, New York, N. Y.

Index: 250.1
Date: August, 1942
Page: 1 of 1 p.

There are a great many drilling, well repair and well completion operations wherein enlargement of the bore of the hole or scraping the face of the formation, is either desirable or necessary. In addition, there is the popular practice of ***removing sections of drillable pipe** to serve as windows for producing zones. For such applications, operators have come to depend upon the safety and performance of the Baker Rotary Wall Scraper. The important **safety and savings** feaures of this tool, together with application details, are given below:

REMARKABLE REAMING CAPACITY

The Baker Wall Scraper provides a means of enlarging the walls of an open hole to a diameter considerably greater than that of the casing or hole through which the tool is run. The reaming capacity of this tool in relation to its O.D. is really remarkable, having a maximum expansion range on the Blades of from 4" to 36". For example, the No. 6 Scraper will run through 9⅝" A.P.I. casing and then ream from a minimum of 9¼" to a maximum of 19".

SAFETY

The design and operation of this tool minimizes any hazard of sticking it in the hole. **That means there is little danger of a costly fishing job and possible loss of precious drill pipe.** The safety and performance of the Baker Wall Scraper has been ably demonstrated in many thousands of successful runs.

SIMPLY CONSTRUCTED, EASY TO OPERATE

The Baker Wall Scraper is constructed of a minimum number of essential parts, with an operating principle so simple that there is little to get out of order . . . **that means no loss of expensive rig time due to failure of the tool to properly function.** Any experienced driller can secure successful first-time results with this "easy-to-operate" device.

TWO TOOLS IN ONE

The Baker Wall Scraper is really "two tools in one", since by merely substituting Sampler Blades for the regular Scraper Blades, converts the tool into a Baker Wall Sampler. With this device, it is possible to take actual cores from the side walls of any uncased hole at any depth. The percentage of core recovery is high and cores are all of a size adequate for accurate laboratory analysis.

HERE IS DOUBLE VALUE FOR YOUR MONEY . . . TWO EFFICIENT TOOLS FOR THE PRICE OF ONE.

TIME AND MONEY-SAVING APPLICATIONS

Several practical applications for the Baker Wall Scraper are illustrated in Figs. 3 to 6. Others are listed below. Note particularly the ability of the tool to remove sections of drillable pipe to serve as windows for producing zones.

Enlarging Holes for Casing

Cleaning Up Oil Sands

Setting Liners

Setting Cement Plugs

Bottlenecking for Cement Jobs

***REMOVING SECTIONS OF DRILLABLE PIPE**

Water Shut-Off Tests

Sidetracking

Straightening Holes

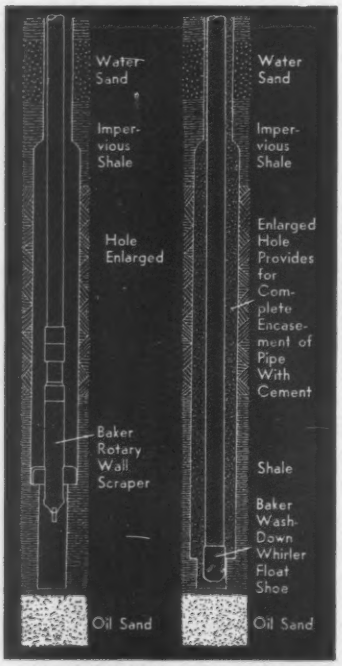
Fishing Jobs

Enlarging Holes for Gravel Packing

Side Wall Sampling (by converting Scraper into Baker Wall Sampler)

Service Note

Competent Baker men will service, make suggestions, and otherwise assist in securing best possible results.



BOTTLENECKING THE HOLE FOR BETTER CEMENTING

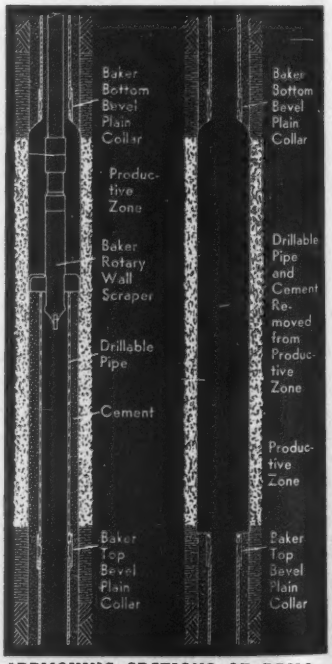
Fig. 3—Showing use of Baker Wall Scraper to enlarge hole for bottlenecking job.

Fig. 4—Showing how bottleneck permits uniform body of cement at Shoe joint.

Fig. 1
Product No. 500
Baker Rotary Wall Scraper

Fig. 2
Product No. 502
Baker Rotary Wall Sampler

For complete details concerning the design, construction and operation of the Baker Wall Scraper and Baker Wall Sampler see pages 279 to 287 of the 1942 Baker, or Composite Catalog. Also send for 40-page, illustrated treatise, describing in detail various applications for this tool.



**REMOVING SECTIONS OF DRILLABLE PIPE*

Fig. 5 — Showing Wall Scraper removing sections of drillable pipe and cement behind the pipe.

Fig. 6 —Showing drillable pipe removed, the formation scraped and zone ready for production.

Avg. daily production during March, 1942: 16,844 bbls.

Maximum effective rate, March, 1942: 28,056 bbls.

Thick and highly productive bodies of Pliocene sand characterize Inglewood-Baldwin Hills (Culver City) field. The newly discovered Topango zone (Sentous) adds a new Miocene producing horizon to Los Angeles Basin and is of considerable geological significance.

LAWNDALE FIELD—

Location: South of Inglewood (Los Angeles County)

Discovery date: 1928, by Smith Pet. Co. No. 1.

Method: Structure found by core hole exploration.

Geology

Type structure: Unconformity on a moncline.

Age producing horizon: Repetto-Puente contact.

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Lawndale		5400-5800	30

Character reservoir: Sand and shale.

Development

Proven area: 72 acres.

Number wells: effective, 0; ineffective, 0; producing, 3. Total 3.

Deepest well: 7405: Miocene.

Production

1941: 10,313 bbls.

Total production to 1942: 1,070,600 bbls.

Avg. daily production during March, 1942: 24 bbls.

Maximum effective rate, March, 1942: 26 bbls.

Completion of San Clemente Oil Co. Peck No. 1, flowing 1000 B/D caused the drilling of 63 wells in the next few months only 6 of which produced any oil.

LOS ANGELES CITY HILLS FIELD—

N. W. Metropolitan area.

Location: Los Angeles County.

Discovery date: 1892, by E. L. Doheny.

Method: Drilling near seepages.

Geology

Type structure: Faulted anticlines—several areas of production.

Age producing horizon: Repetto and Puente.

Name Producing Horizon	Avg. Depth	Gravity
Not defined	400-3000	13-17

Character reservoir: Sand.

Development

Proven area: 1627 acres.

Number wells: effective, 0; ineffective, 0; producing, 82. Total, 82.

Depths: 400-3000.

Deepest well: 5074.

Production

1941: 187,546 bbls.

Total production to 1942: 60,031,823 bbls.

Average daily production during March, 1942: 168 bbls.

Maximum effective rate, March, 1942: 165 bbls.

Brea pits in Western Los Angeles attracted attention of the Padres. Most of the present oil development was completed prior to 1910 and the area has lacked exploration due to rapid expansion of residential territory with drilling restrictions. It is the only sizeable area which has not undergone exploratory drilling during the last ten years.

LONG BEACH FIELD—

Location: Signal Hill at Long Beach (Los Angeles County).

Discovery date: June, 1921, by Shell Oil Co.

Method: Drilling on anticlinal structure.

Geology

Type structure: Elongated anticline.

Age producing horizon: Repetto-Puente (Plio-Mio).

Name Producing Horizon	Avg. Depth	Gravity
Wilbur	2400	22
Alamitos	2650	23
Brown	3250-5700	28
Deep	5700-8200	26
DeSoto	10,000	30

Character reservoir: Sand.

Development

Proven area: 1600 acres.

Number wells: Effective, 28; ineffective, 0; producing, 1233. Total, 1261.

Depths: 2400-10,000.

Deepest well: 10,720; Miocene.

Production

1941: 14,516,548 bbls.

Total production to 1942: 663,664,354 bbls.

Average daily production during March, 1942: 35,000 bbls.

Maximum effective rate March, 1942: 40,424 bbls.

Long Beach has recovered the greatest amount of oil of any field in Los Angeles Basin, having produced up to 1942 663,664,354 barrels of oil since discovery in 1921. It has the thickest producing section, oil sands aggregating 4000 feet and is the foremost example of townlot drilling with 1239 wells now producing within its 1600 proven acres. It still produces 38,300 barrels oil, 91,300 barrels water and 33,000 M.C.F. gas per day. Long Beach is second only to the enormous Midway-Sunset fields in total amount of oil produced in California.

MONTEBELLO FIELD—

Location: Hills north and east of Montebello (Los Angeles County).

Discovery date: 1917, by Standard Oil Co. (Baldwin No. 1).

Method: Drilling on anticline.

Geology

Type structure: Anticlines and unconformity.

Age producing horizon: Repetto and Puente.

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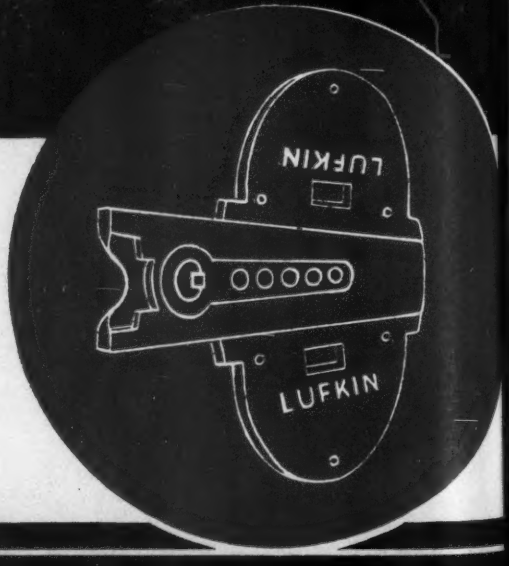

LUFKIN PUMPING UNITS

LUFKIN-UNITS are manufactured in Lufkin, Texas, by the Lufkin Foundry & Machine Company. Branches in principal oil centers

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Montebello	850	1700-4500	13
Cruz	125	4000-6000	to 24

Character Reservoir: Sand.

Development

Proven area: 1658 acres.

Number wells: Effective, 5; ineffective, 30; producing, 188. Total, 223.

Depths: 1700-5500.

Deepest well: 8468, Standard Oil No. 84; Miocene.

Production

1941: 2,063,308 bbls.

Total production to 1942: 124,452,483 bbls.

Avg. daily production during March, 1942: 5509 bbls.

Maximum effective rate March, 1942: 7119 bbls.

WEST MONTEBELLO FIELD—

Location: South flank of Montebello hills.

Discovery date: 1939, by Kern Oil Co.

Method: Deep drilling down flank of Montebello anticline.

Geology

Type structure: Em. echelon anticline.

Age producing horizon: Puente.

Name Producing Horizon	Avg. Depth	Gravity
Zone 5	6000	30
6	6400	
7	7100	to
8	7500	
9	9000	50

Character reservoir: Sand.

Development

Proven area: 500 acres.

Number wells: effective, 14; ineffective, 0; producing, 160. Total, 174.

Depths: 6000-9000.

Deepest well: 9334, Standard Oil Co. No. 82.

Production

1941: 2,796,278 bbls.

Total production to 1942: grouped with Montebello.

Avg. daily production during March, 1942: 4174 bbls.

Maximum effective rate, March, 1942: 5730 bbls.

NEWHALL-POTRERO FIELD—

Location: Rancho San Francisco (L. A. County).

Discovery date: May, 1937, by Barnsdall Oil Co.

Method: Detail field geology.

Geology

Type structure: Anticline—Modified by faulting.

Age producing horizon: Modelo—Miocene.

Name Producing Horizon	Avg. Depth	Gravity
San Francisco 1	6250	33
San Francisco 2	6575	to
San Francisco 3	6850	37

Character reservoir: Sand.

Development

Proven are: 600 acres. Undergoing gradual development.

Number wells: effective, 0; ineffective, 0; producing, 27. Total 27.

Depths: 6200-6900.

Deepest well: 7827, Miocene, No. 26.

Production

1941: 998,103 bbls.

Total production to 1942: 2,274,790 bbls.

Avg. daily production during March, 1942: 2660 bbls.

Maximum effective rate, March, 1942: 2794 bbls.

PLAYA DEL REY-VENICE FIELD—

Location: Tidelands south of Venice.

Discovery date: December, 1929, by Ohio Oil Co.

Method: Detailed study of region from well logs.

Geology

Type structure: Anticline over schist high.

Age producing horizon: Pliocene, Miocene and Jurassic.

Name Producing Horizon	Avg. Depth	Gravity
Upper (Venice only) (Repetto)	4200-4600	18
Lower (Puente and Franciscan)	5900-6500	25

Character reservoir: Upper, sand; lower, conglomerate and schist.

Development

Proven area: 615 acres.

Number wells: Effective, 3; ineffective, 0; producing, 142. Total, 145.

Depths: 3800-6900.

Deepest well: 7048; Franciscan schist.

Production

1941: 1,288,072 bbls.

Total production to 1942: 47,488,128 bbls.

Avg. daily production during March, 1942: 3383 bbls.

Maximum effective rate March, 1942: 3690 bbls.

POTRERO FIELD—

Location: East of Inglewood (Los Angeles County).

Discovery date: 1928, by Associated Oil Co.

Method: Drilling along Inglewood Fault.

Geology

Type structure: Faulted anticline.

Age producing horizon: Repetto and Puente (Pliocene-Miocene).

Name Producing Horizon	Avg. Depth	Gravity
Many thin zones.....	3600-6500	33-48

Character reservoir: Sand.

Development

Proven area: 140 acres.

Number wells: Effective, 1; ineffective, 0; producing, 24. Total, 25.

Depths: 3400-7500.

Deepest well: 9923, Miocene; Basin Oil Co. Potrero No. 2.

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Many operators find too, that a reduction in rotary speeds, while using Reed Rock Bits, will save wear on the O.D. of their tool joints.

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REED ROLLER BIT CO.

POST OFFICE BOX 2119 HOUSTON, TEXAS

Production

1941: 709,616 bbls.

Total production to 1942: 4,276,660 bbls.

Avg. daily production during March, 1942: 958 bbls.

Maximum effective rate March, 1942: 1175 bbls.

The successful production of Potrero sands depends on accurate logging of both oil and water zones which are relatively thin. Engineering control and modern completion practices have increased production and extended the proven area.

RICHFIELD FIELD—

Location: Minor hills east of Placentia (Orange County).

Discovery date: 1919, by Union Oil Co., Chapman No. 1.

Method: Test well on anticline.

Geology

Type structure: Anticline with two small domes.

Age producing horizon: Repetto-Puente.

Name Producing Horizon	Avg. Depth	Gravity
Chapman—Upper	2700	16
Chapman—Lower	3400	20
Kraemer	3700	25

Character reservoir: Sand.

Development

Proven are: 1290 acres.

Number wells: effective, 6; ineffective, 2; producing, 299. Total 307.

Depths: 2900-4100.

Deepest well: 10,496. Oligocene?

Production

1941: 2,476,671 bbls.

Total production to 1942: 92,120,961 bbls.

Avg. daily production during March, 1942: 7569 bbls.

Maximum effective rate, March, 1942: 9188 bbls.

ROSECRANS-ATHENS FIELD—

Location: South of Los Angeles (Los Angeles County).

Discovery date: 1924, by Union Oil Co., Potter No. 1.

Method: Subsurface exploration.

Geology

Type structure: Anticline with fault traps.

Age producing horizon: Repetto-Puente.

Name Producing Horizon	Avg. Depth	Gravity
Maxwell-Hoge	3900-5000	30
Zinns	5700-6500	34
O'Dea	6500-7500	34
8th Callender	8000-8200	32

Character reservoir: Sand.

Development

Proven area: 790 acres.

Number wells: effective, 5; ineffective, 5; producing, 185. Total, 195.

Depths: 4100-8600.

Deepest well: 10,389. Miocene.

Production

1941: 3,433,964 bbls.

Total production to 1942: 48,181,337 bbls.

Avg. daily production during March, 1942, 7348 bbls.

Maximum effective rate, March, 1942: 8368 bbls.

SANTA FE SPRINGS FIELD—

Location: 12 miles southeast of Los Angeles (Los Angeles County).

Discovery date: 1919, by Union Oil Co.

Method: Wildcat drilling on minor topographic feature.

Geology

Type structure: Dome.

Age producing horizon: Repetto.

Name Producing Horizon	Avg. Depth	Gravity
Foix	3475-3700	28-30
Bell-Meyers	3800-4800	32-36
Nordstrom	4900-5450	32-36
Buckbee	5650-6300	32-38
O'Connell	6300-7300	31-37
Clark-Hathaway	7100-8200	30-39

Development

Proven area: 1630 acres.

Number wells: effective, 24; ineffective, 25; producing 582. Total 631.

Depths: 3500-7200

Deepest well: 11,314, Union Oil Co. No. 100. Miocene.

Production

1941: 8,536,871 bbls.

Total production to 1942: 477,164,924 bbls.

Avg. daily production during March, 1942: 18,733 bbls.

Maximum effective rate, March, 1942: 24,676 bbls.

Of the L. A. Basin oil fields, Santa Fe Springs, is rated second in size according to past production. It is the best example of a domal type structure in California. Its zones were progressively drilled, but now that the deeper sands are nearly depleted operators are plugging back and perforating the Meyer zone which produced much oil during the period 1920 to 1928.

SEAL BEACH FIELD—

Location: Adjoining Alamitos (Los Angeles County)

Discovery date: August, 1926, by Continental Oil Co. Bixby No. 2.

Method: Wildcat drilling on reconstructed topography.

Geology

Type structure: Dome with 200-ft. closure along fault.

Age producing horizon: Repetto-Puente (Pliocene-Miocene).

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Bixby-Selover	450	4400-4850	22-28
Wasem	950	5250-6200	25-28
McGrath	950	6300-7250	25-28
Deep zone		8400	29

Character reservoir: Coarse to medium grained sand bodies separated by thin beds of shale.

Development

Proven area: 240 acres.

Number wells: Effective, 2; ineffective, 7; producing, 94. Total, 103.

Depths: 4314-6428.

Deepest well: Continental No. 24, 9054 ft.

Production

1941: 2,022,102 bbls.

Total production to 1942: 65,705,085 bbls.

Avg. daily production during March, 1942: 7191 bbls.

Maximum effective rate March, 1942: 11,702 bbls.

Bixby, Selover and Wasem zones have produced most of the oil to date.

TORRANCE-HERMOSA FIELD—

Location: North of Palos Verdes uplift (Los Angeles County).

Discovery date: 1922, by Chanslor Canfield Midway Oil Co.

Method: Surface geology.

Geology

Type structure: Elongated anticline plunging SE.

Age producing horizon: Miocene.

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Main	260	3400-3600	13-24
Del Amo or "34"..	110-320	4800-5300	21-27

Character reservoir: Sand.

Development

Proven area: 4310 acres.

Number wells: effective, 26; ineffective, 9; producing, 638. Total, 673.

Depths: 2400-5200.

Deepest well: 5938. Schist. Superior Oil Co.

Production

1941: 3,154,639 bbls.

Total production to 1942: 104,217,953 bbls.

Avg. daily production during March, 1942, 8909 bbls.

Maximum effective rate, March, 1942: 8638 bbls.

The Del Amo or "34" Zone, discovered in 1937 by C.C.M.O. Co., is productive only along the SE flank of the field and is comparable to the Ford Zone at Wilmington. Recent development indicates that production in the Main Zone carries through to the Terminal zone at Wilmington.

WHITTIER FIELD—

Location: Hills east of Whittier (Los Angeles County).

Discovery date: 1898, by Central Oil Co., No. 1.

Method: Wildcat near seepage.

Geology

Type structure: Monocline against fault.

Age producing horizon: Repetto-Puente (Pliocene-Miocene).

Name Producing Horizon	Avg. Depth	Gravity
Seven producing zones principally in the Repetto	200-3000	14-29

Character reservoir: Medium to fine grained sand bodies in lower Pliocene shale.

Development

Proven area: 600 acres.

Number wells: effective, 8; ineffective, 11; producing, 157. Total 176.

Depths: 200 to 3000.

Deepest well: 5045, Standard Oil Co., Home No. 21.

Production

1941: 172,242 bbls.

Total Production to 1942: 18,418,069 bbls.

Avg. daily production during March, 1942: 1025 bbls.

Maximum effective rate, March, 1942: 1062 bbls.

One hundred wells have been abandoned since the field was discovered 44 years ago.

WILMINGTON FIELD—

Location: Wilmington & Long Beach Harbor (Los Angeles County).

Discovery date: 1936, by General Petroleum Corp.

Method: Geophysical discovery.

Geology

Type structure: Dome modified by faulting.

Age producing horizon: Repetto-Puente (Plio-Mio).

Name Producing Horizon	Avg. Depth	Gravity
Tar	1900-2600	12-15
Ranger	2350-3450	13-20
Terminal	3000-3900	17-30
Ford	5200-5600	23-32

Character reservoir: Sand.

Development

Proven area: 4400 acres.

Number wells: effective, 8; ineffective, 0; producing 1085. Total, 1093.

Deepest well: 6901. Bottom in schist.

Production

1941: 30,542,409 bbls.

Total production to 1942: 140,021,211 bbls.

Avg. daily production during March, 1942: 88,884 bbls.

Maximum effective rate, March, 1942: 125,851 bbls.

Production within the field varies with distribution of sand and relationship to faults. Producing zones to the NW have joined with those of the Torrance field. Production extends for a considerable distance beneath the ocean floor and is partially developed by directing wells from the shore. Southeast field limits have not been determined because of a Long Beach city ordinance prohibiting drilling east of L. A. county Flood Control channel. Because of its large areal extent and the thickness of producing horizons, Wilmington will approach one billion bbls. in ultimate recovery.

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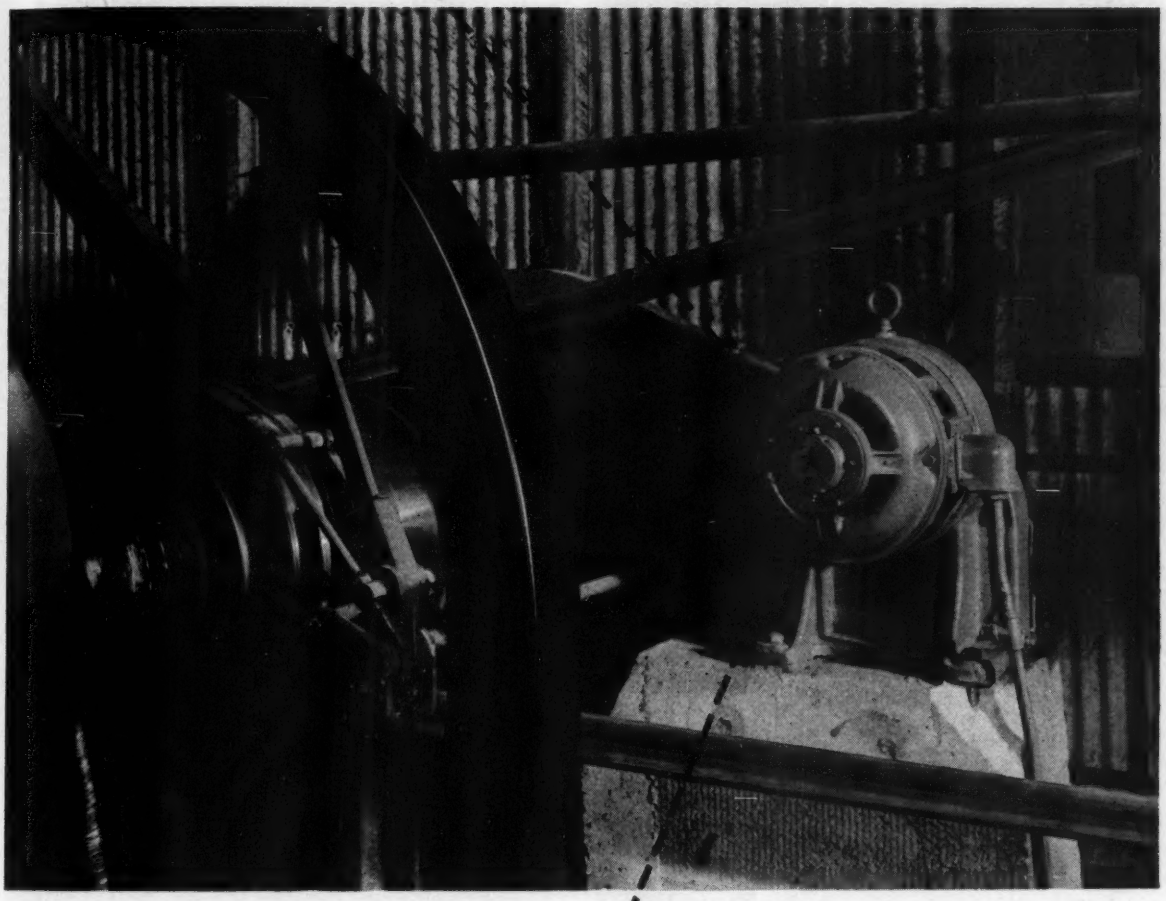

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Coastal Fields

Ventura and Santa Maria Districts produced over thirty-one of California's two hundred twenty-nine million barrels of oil during 1941. Of this amount two fields, Ventura Avenue and Santa Maria Valley, contributed over eighteen million barrels. During the coming year, with emphasis on kind of oil and transportation facilities, it would seem that the Coastal areas may increase their output. One new discovery, the Oak Canyon field, lies at the extreme eastern portion of the Ventura Basin. The major production, however, will come from known fields which have been curtailed rather severely for a number of years past.

Grouped in the Coastal Area are a number of small fields which could not conveniently be treated separately because of insufficient production data. They are important historically for they were both the foundation and stimulus for California's oil industry. Developed between 1875 and 1900 and still pumping, their present contribution to the state's total production is negligible. These fields lie within the Ventura Basin and will be mentioned according to locality.

1. Ventura-Ojai District:
   Tip-Top and Fresno Canyon.
2. Simi Valley District:
   Conejo and Scarab Areas.
3. Santa Paula District:
   Ex-Mission, Sisar, Silver Thread,
   Sulphur Mountain and Timber Canyon fault.
4. Piru District:
   Hopper, Modelo, Tapo-Eureka, and Torrey Canyons. A small structure known as Temescal Canyon was developed in 1924.

Operators were attracted to the above areas because of oil seepages or very evident anticlinal structure. It is interesting to note that during the Civil War some mining operations were tried north of Ventura. The first development by drilling is credited to Pico Canyon, which developed into an oil field and later had a refinery. It should be mentioned here, however, that drilling had previously been tried south of Eureka, in Humboldt County, and a few barrels of oil were shipped to San Francisco prior to any commercial use of oil in Southern California.

Geologically, Ventura and Santa Maria Districts are elongated basins filled with Tertiary sediments. The Ventura basin is the trough between the Santa Ynez and San Gabriel on the North and the Santa Monica Mountains group on the South. It contains the thickest Tertiary section in California and oil is produced from all its four main divisions,—Pliocene, Miocene, Oligiocene, and Eocene. As would be expected from such a wide range of strata, oils vary considerably from mixed to asphaltum base. Production is obtained generally from sands in anticlinal structure.

Santa Maria Basin is a wedge shaped basin between the Santa Ynez and San Rafael Mountain Ranges. This has been filled with Upper Tertiary sediments. Oligiocene deposits are not widespread and Eocene strata are lacking altogether.

Oil is obtained principally from the fractured Monterey chert of Miocene age although some local heavy oil production is found in the Sisquoc, which is regarded as a transition zone of lower Pliocene.

Original fields were discovered by drilling on anticlines but the bulk of production is now obtained from the Santa Maria Valley field, which is an overlap or stratigraphic type of accumulation. Production is obtained principally from fractured "Monterey chert." Folding or faulting augments the fracturing of the brittle sediments and it is in connection with these conditions that the best producers are found.

CAPITAN FIELD—

Location: Santa Barbara County (20 miles west of Santa Barbara).

Discovery date: Oct. 8, 1929, by General Pet. Corp., Eburu No. 1.

Method: Drld. on surface structure.

Geology

Type structure: Anticline, faulted on north side.

Age producing horizon: Miocene (Vaqueros)-Oligocene (Sespe).

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Zone 1—Vaqueros	100	1400	16-22
Zone 2—Sespe	200	2700	34-43

Character reservoir: Sand.

Development

Proven area: 296 acres.

Number wells: effective, 54; ineffective, 3; producing 1. Total, 58.

Depths: 1400-2734.

Deepest well: 4071.

Production

1941: 740,309 bbls.

Total production to 1942: 5,346,933.

Avg. daily production during March, 1942: Shut in.

Maximum effective rate, March, 1942: 6200 bbls.

Following the discovery of Elwood field, Capitan, named from El Capitan canyon, was discovered by General Pet. Corp.'s Eburu No. 1. Drilled to 1368 ft. it produced 115 B/D, of 19 grav. oil from the upper part of the Vaqueros sand. Several years afterward Eburu No. 8 was completed at 2422 ft. as a producer from the Sespe.

The field is operated by two companies: General Pet. Corp. & Shell Oil Co., Inc., and while not nearly so productive as Elwood, it is nevertheless a valuable field due to good quality of oil at shallow depths.

CASMALIA FIELD—

Location: Casmalia Hills, 8 miles Southwest of Santa Maria (Santa Barbara County).

Discovery date: July, 1904, by Kern Trading & Oil Co. No. 1.

Method: Wildcat drilling on anticline.

Geology

Type structure: Plunging anticline.

Age producing horizon: Miocene.

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Zone 1			
Monterey Chert	300-400	2800	8.5-11

Character Reservoir: Fractured chert in Monterey shale.

Development

Proven area: 1010 acres.

Number wells: effective, 4; ineffective, 55; producing, 5. Total, 64.

Depths: 700-2800.

Deepest well: 3900. Lospe-Oligocene.

Production

1941: 130,482 bbls.

Total Production to 1942: No record.

Avg. daily production during March, 1942: 165 bbls.

Maximum effective rate, March, 1942: 950 bbls.

Casmalia has the distinction of producing the heaviest oil in the state. The oil which ordinarily sinks in water, can only be pumped from the wells because of high bottom hole temperature. After reaching the surface it is either further heated by steam or mixed with distillate to facilitate handling. It is used primarily for the manufacture of asphaltic products.

CAT CANYON (EAST) FIELD—

Location: Eastern Solomon Hills (Santa Barbara County), 13 miles Southeast of Santa Maria.

Discovery date: June, 1906, by Brooks Oil Co.

Method: Wildcat.

Geology

Type structure, Plunging anticline.

Age producing horizon: Basal Pliocene.

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Oil Zone	3000	3400	12-13

Character Reservoir: Sand

Development

Proven area: 400 acres.

Number wells: effective, 0; ineffective, 20; producing, 1. Total. 21.

Depths: 2800-3800.

Deepest well, 7199. Oligocene.

1941: 4,939 bbls.

Production

Total production to 1942: No record.

Avg. daily production during March, 1942: 15 bbls.

Maximum effective rate, March, 1942: 15 bbls.

CAT CANYON (WEST) FIELD—

Location: Solomon Hills, 11 miles Southeast of Santa Maria (Santa Barbara County).

Discovery date: 1908, by Palmer Union Oil Co., No. 1.

Method: Wildcat.

Geology

Type structure: Nose on north flank of Santa Maria Hills.

Age producing horizon: Miocene.

Name Producing Horizon	Avg. Depth	Gravity
Sisquoc	2800-3000	13-14

Character reservoir: Sand.

Development

Proven area: 800 acres.

Number wells: effective, 1; ineffective, 33; producing, 9. Total 43.

Depths: 2400-3100.

Deepest well: 4200. Miocene.

Production

1941: 219,676 bbls.

Total production to 1942: No record.

Avg. daily production during March, 1942: 484 bbls.

Maximum effective rate, March, 1942: 800 bbls.

The Cat Canyon fields are separate accumulations and structures are on the North flank of Solomon Hills uplift, and have little in common geologically. Both produce heavy high sulphur oil which has been used in the manufacture of road material for many years.

EDNA-PISMO (ARROYO GRANDE) FIELD—

Location: San Luis Obispo County.

Discovery date: 1911, by Associated Oil Co.

Method: Drilling in tar sands.

Geology

Type structure: Plunging anticline.

Age producing horizon: Pliocene-Pismo.

Name Producing Horizon	Avg. Depth	Gravity
Zone 1—Edna	500-1200	13
Zone 2—Pismo	3500	16

Character reservoir: Sand.

Development

Proven area: 225 acres.

Number wells: effective, 2; ineffective, 7; producing, 9. Total, 18.

Depths: 500-3500.

Deepest well: 4425. Elberta Oil Co.

Production

1941: 13,056 bbls.

Total production to 1942: 846,147.

Avg. daily production during March, 1942: Shut in.

Maximum effective rate, March, 1942: 15 bbls.

ELWOOD FIELD—

Location: On Beach, 12 miles west of Santa Barbara (Santa Barbara County).

Discovery date: July 26, 1928, by Barnsdall-Rio Grande Co., Luton-Bell No. 1.

Method: Drlg. surface structure.

Geology

Type structure: Elongated anticline against a fault.

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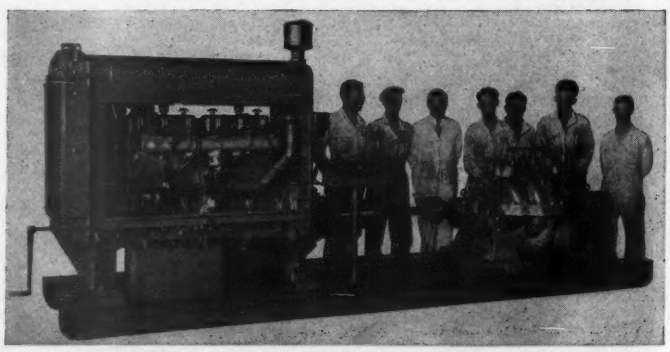

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Age producing horizon: Miocene (Vaqueros) Oligocene (Sespe).

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Zone 1—Vaqueros ..	300	3164	23-38
Zone 2—Sespe	175	4400	40 plus

Character reservoir: Sand.

Development

Proven are: 520 acres.

Number wells: effective, 85; ineffective, 4; producing, 51. Total, 140.

Depths: 3100-4400.

Deepest well: 7157. Eocene.

Production

1941: 1,159,385 bbls.

Total production to 1942: 67,256,269.

Avg. daily production during March, 1942: 1541 bbls.

Maximum effective rate, March, 1942: 4500 bbls.

Oil slicks beyond the breaker line together with many seepages or oil stained formation in the steep dipping Miocene beds along the coast of Santa Barbara county attracted oil men since the earliest discoveries in California. Few geologists would recommend the area until the discovery well, Luton-Bell No. 1 came in for 1750 B/D at 3208 ft. Some of the more evident structures were soon drilled which yielded two additional oil fields and a large gas field.

Elwood, besides being the opening field for a new oil district, has the following claims for fame: (1) very high acre-foot recovery for an entire field; (2) large portion of structure developed by wells drilled in the ocean from long piers; and (3) first U.S. soil shelled by a Japanese submarine.

GATO RIDGE FIELD—

Location: Eastern Solomon Hills, 16 miles Southeast of Santa Maria (Santa Barbara Co.).

Discovery date: June 1931, by Barnsdall Oil Co.

Method: Drilling on anticline.

Geology

Type structure: Faulted anticline.

Age producing horizon: Miocene.

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Zone 1—			
Monterey Chert	800 plus	2600-3200	12-14

Character reservoir: Fractured chert and fissures in siliceous shale.

Development

Proven area: 800 acres.

Number wells: effective, 2; ineffective, 6; producing, 13. Total, 21.

Depths: 1800-3200.

Deepest well: 6510. Vaqueros.

Production

1941: 1,377,735 bbls.

Total production to 1942: 5,579,611.

Avg. daily production during March, 1942: 3292 bbls.

Maximum effective rate, March, 1942: 6000 bbls.

Production is obtained from the crest of a long anticline. It is thought that the chert or siliceous shale, which acts as a reservoir for the oil, was fractured by folding of the strata.

LAS FLORES FIELD—

Location: Central Solomon Hills (Santa Barbara County).

Discovery date: Aug. 1938 by Standard Oil Co., Las Flores No. 1.

Method: Detail mapping of geology.

Geology

Type structure: Faulted anticline.

Age producing horizon: Miocene.

Name Producing Horizon	Avg. Depth	Gravity
Zone 1—		13.2 to
Monterey chert	6440	17.9

Character reservoir: Fractured chert and sand.

Development

Proven area: Approx. 400 acres.

Number wells: effective, 0; ineffective, 0; producing, 7. Total, 7.

Depths: 5500-6100.

Deepest well: 6586.

Production

1941: 125,952 bbls.

Total production to 1942: Grouped with Cat Canyon.

Avg. daily production during March, 1942: 1120 bbls.

Maximum effective rate, March, 1942: 1985 bbls.

This recent discovery is still undergoing development but for the present may be regarded as a fault accumulation on the east end of the Orcutt or Santa Maria field.

LOMPOC FIELD—

Location: 6 miles north of Lompoc, Purissima Hills (Santa Barbara County).

Discovery date: Feb., 1903, by Union Oil Co., Hill No. 1.

Method: Wildcat well on anticline.

Geology

Type structure: Faulted anticline.

Age producing horizon: Miocene.

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Zone 1—			
Monterey chert	700	2200-2700	19-21

Character reservoir: Fractured shale.

Development

Proven area: 2215 acres (has additional undeveloped acreage.

Number wells: effective, 4; ineffective, 23; producing, 8. Total, 35.

Depths: 2200-2900.

Deepest well: 4310.

Production

1941: 161,428 bbls.

Total production to 1942: No record.

Avg. daily production during March, 1942: 516 bbls.
Maximum effective rate, March, 1942: 2226 bbls.

Lompoc field extends along the south flank of Purissima Hills for a distance of four miles. The discovery well Hill No. 1, located at the eastern end, came in for 225 B/D and continued to flow for 21 years which should be some kind of a record. This field is owned principally by the Union Oil Co. and is considered to be the first "unit operation" in Calif.

ORCUTT (SANTA MARIA) FIELD—

Location: Solomon Hills, 10 miles South of Santa Maria (Santa Barbara County).
Discovery date: July, 1903, by Western Union Oil Co., Careaga No. 1.
Method: Drilling near seepage.

Geology

Type structure: Asymetric anticline.
Age producing horizon: Miocene-Monterey shale and Vaqueros.

Name Producing Horizon	Avg. Depth	Gravity
Tar	1100	18
1st zone	2900-3110	to
2nd zone	3500-3700	26

Character reservoir: Fractured Monterey shale.

Development

Proven area: 4220.
Number wells: effective, 29; ineffective, 46; producing, 156. Total, 231.
Depths: 1100-4280.
Deepest well: 5815. Sespe-Oligocene.

Production

1941: 1,137,316 bbls.
Total production to 1942: No record.
Avg. daily production during March, 1942: 2745 bbls.
Maximum effective rate, March, 1942: 4582 bbls.

The discovery of Santa Maria as a second field only five months after Lompoc attracted the attention of operators to the district. The well was reported to be capable of flowing 500 B/D and stimulated development. Some three years later Union Oil Co. Hartnell No. 1, blew in at an estimated flow of 12,000 barrels and prospecting began in earnest. Several fields were found but all produced heavy oil and operators were gradually attracted to other parts of the state.

Differing from most fields of California, production is obtained from fractured chert layers of Monterey shale instead of sand. After nearly 40 years it produces 3000 barrels of oil per day along with an equal amount of water.

OXNARD FIELD—

Location: East of Oxnard, Ventura county.
Discovery date: 1937, by El Rio Oils-Canada Ltd.
Method: Wildcat drilling.

Geology

Type structure: Monocline—unconformity.
Age producing horizon: Miocene-Modelo.

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Modelo sand	150	2800	6-10

Character reservoir: Sand.

Development

Proven area: 490.
Number wells: effective, 0; ineffective, 1; producing, 2. Total, 3.
Depths: 2100-2700.
Deepest well: 4270. Modelo.

Production

1941: 77,914 bbls.
Total production to 1942: No record.
Avg. daily production during March, 1942: 555 bbls.
Maximum effective rate, March, 1942: 325 bbls.

Oil is extremely heavy and recovery is difficult. Exploratory projects are attempting to locate accumulation of lighter oil.

PADRE CANYON (JAVON) FIELD—

Location: 6 miles Northwest of Ventura (Ventura County).
Discovery date: Feb. 1936, by Continental Oil Co., Hobson No. 1.
Method: Surface and subsurface geology.

Geology

Type structure: faulted anticline.
Age producing horizon: Pliocene.

Name Producing Horizon	Avg. Depth	Gravity
Hobson	5800	28-31

Character reservoir: Sand.

Development

Proven area: 180 acres.
Number wells: effective, 0; ineffective, 0; producing, 19. Total 19.
Depths: 4800-5900.
Deepest well: 6751. Miocene.

Production

1941: 366,024 bbls.
Total production to 1942: (Estimated), 1,514,000 bbls.
Avg. daily production during March, 1942: 944 bbls.
Maximum effective rate, March, 1942: 1245 bbls.

SAN MIGUELITO-PADRE CANYON: These two fields are located in the hilly terrain north of Ventura where the placing of a drilling site is an engineering accomplishment. The rough topography had prevented some operators from considering development so consequently one company has both fields under lease. They are on an extension of anticlinal uplift west of Ventura Avenue.

RINCON FIELD—

Location: 7 miles Northwest of Ventura (Ventura County).
Discovery date: Dec., 1927, by Pan. Am. Pet. Co., Fee No. 3.
Method: Drilling on surface structure.

Geology

Type structure: Plunging anticline.

Age producing horizon: Pliocene-Repetto.

Name Producing Horizon	Avg. Depth	Gravity
Hobson, Tomson, Miley.....	3800-6000	25-31

Character reservoir: Sand.

Development

Proven are: 425 acres.

Number wells: effective, 15; ineffective, 0; producing, 62. Total, 77.

Depths: 3500-6500.

Deepest well: 10,515. Pliocene. C. C. M. O. Hobson, No. C-3.

Production

1941: 1,538,169 bbls.

Total production to 1942: (Est'd) 14,000,000 bbls.

Avg. daily production during March, 1942: 2733 bbls.

Maximum effective rate, March, 1942: 3497 bbls.

The first test location was made after study of a partially exposed anticline in the ocean cliffs and was the discovery well for the field. Submarine geology prompted tideland development of the first well to be drilled from a "steel island" was located about 1500 ft. from the shore at Rincon.

SANTA BARBARA MESA FIELD—

Location: Adjoining Western Santa Barbara (Santa Barbara County).

Discovery date: 1929, by Olympic Oil & Gas Co., Lomas No. 1.

Method: Wildcat well.

Geology

Type structure: Faulted monocline.

Age producing horizon: Vaqueros (Miocene).

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Vaqueros	45	1950-2100	14-19

Character reservoir: Sand.

Development

Proven area: 165 acres.

Number wells: effective, 0; ineffective, 0; producing, 21. Total, 21.

Depths: 1950-2200.

Deepest well: 4730. Sespe.

Production

1941: 74,218 bbls.

Total production to 1942: 3,354,140.

Avg. daily production during March, 1942: 147 bbls.

Maximum effective rate, March, 1942: 175 bbls.

When the Olympic well came in for an estimated 1150 B/D rate, residents of Santa Barbara had visions of a townlot boom. However, a rapid decline in production together with presence of complicated faulting resulted in abandonment of many operations. About 140 wells were drilled on 800 acres but most of them were abandoned so that now only 21 producers remain.

SANTA MARIA VALLEY FIELD—

Location: Adjoins Santa Maria to the South (Santa Barbara County).

Discovery date: Sept., 1934, by Union Oil Co., Moretti No. 1.

Method: Subsurface geology and geophysical determinations.

Geology

Type structure: Overlapped monocline.

Age producing horizon: Monterey-Sisquoc (Miocene, Pliocene).

Name Producing Horizon	Avg. Depth	Gravity
Sisquoc	2000	12
Sta. Margarita	2900-4600	to
Monterey Chert	3400-5500	17

Character reservoir: Sand and fractured Monterey shale.

Development

Proven are: 5230 acres.

Number wells: effective, 43; ineffective, 2; producing, 184. Total 229.

Depths: 2900-4900.

Deepest well: 8133, Franciscan.

Production

1941: 6,848,542 bbls.

Total production to 1942: 22,149,504 bbls.

Avg. daily production during March, 1942: 10,219 bbls.

Maximum effective rate, March, 1942: 31,266 bbls.

The field was discovered after core drilling in the flood plain of Santa Maria Valley. Exploration followed a study of subsurface geology. A Monterey "fractured chert" zone yields most of the production but Sisquoc and Santa Margarita sands produce in local areas. Monterey shale (Miocene) overlaps Franciscan Schist (Jurrasic) and is in turn overlapped by Sta. Margarita and Sisquoc beds. It is one of the few stratigraphic type of oil fields that has yet been found in California.

After 7 years of development the productive limits still are being extended.

SAN MIGUELITO FIELD—

Location: 5 miles Northwest of Ventura (Ventura County).

Discovery date: Sept., 1931, by Continental Oil Co., Grubb No. 1.

Method: Drilling on anticline.

Geology

Type structure: Faulted anticline (plunging).

Age producing horizon.

Name Producing Horizon	Avg. Depth	Gravity
Hobson	5500	29
Grubb—one	6400	to
Grubb—two	6900	34

Character reservoir: Sand.

Development

Proven area: 180 acres.

Number wells: effective, 0; ineffective, 0; producing, 25. Total 25.

Depths: 5500-8000.

Deepest well: 10,030 Pliocene.

Production

1941: 1,063,525 bbls.

Total production to 1942: (Est'd) 5,900,000 bbls.

Avg. daily production during March, 1942: 2528 bbls.

Maximum effective rate, March, 1942: 4750 bbls.

SHIELLS CANYON FIELD—

Location: 4 miles Southeast of Fillmore (Ventura County).

Discovery date: April, 1911, by Montebello Oil Co., Shiells No. 1.

Method: Drilling on anticline.

Geology

Type structure: Dome.

Age producing horizon: Oligocene-Sespe.

Name Producing Horizon	Avg. Depth	Gravity
Zone 1	700-2500	25
Zone 2	2500-3200	
Zone 3	3200-3800	to
Zone 4 (gas)	3800-4400	35

Character reservoir: Sand.

Development

Proven area: 510 acres.

Number wells: effective, 4; ineffective, 17; producing, 117. Total 138.

Depths: 700-4400.

Deepest well: 7423. Eocene.

Production

1941: 374,552 bbls.

Total production to 1942: 10,523,896 bbls.

Average daily production during March, 1942: 1048 bbls.

Maximum effective rate, March, 1942: 980 bbls.

This field like South Mountain was found to have saturated sands and shales from 700 to about 3200 in depth. No intermediate water sands were present and many wells were periodically deepened as upper sands were depleted. Several minor extensions have been added by deeper drilling and initial production as high as 1500 B/D were reported. Declines were rapid and the field remains one of routine activity. One of the early gasoline extraction plants was installed in Shiells Canyon because of the extremely rich gas.

SIMI FIELD—

Location: 4 miles Northeast of Simi (Ventura County).

Discovery date: 1912, by Petrol Oil Co.

Method: Drilling on anticline.

Geology

Type structure: Anticline.

Age producing horizon: Eocene-Meganos.

Name Producing Horizon	Thickness	Avg. Depth	Gravity
One zone	25-100	1200	21-34

Character reservoir: Sand.

Development

Proven are: 635 acres.

Number wells: effective, 6; ineffective, 0; producing, 48. Total, 54.

Depths: 1100-1500.

Deepest well: 3934. Eocene.

Production

1941: 29,932 bbls.

Total Production to 1942: No record.

Avg. daily production during March, 1942: 82 bbls.

Maximum effective rate, March, 1942: 75 bbls.

SOUTH MOUNTAIN FIELD—

Location: 3 miles East of Santa Paula (Ventura County).

Discovery date: April, 1916, by Oak Ridge Oil Co., So. Mt. No. 1.

Method: Drilling on dome.

Geology

Type structure: Dome.

Age producing horizon: Oligocene-Sespe.

Name Producing Horizon	Avg. Depth	Gravity
Various oil sands	800-4500	19-30

Character reservoir: Sand.

Development

Proven area: 785 acres.

Number wells: effective, 4; ineffective, 4; producing, 90, Total 98.

Depths: 800-4500.

Deepest well: 6702, Eocene.

Production

1941: 526,958 bbls.

Total Production to 1942: 22,481,356 bbls.

Avg. daily production during March, 1942: 1494 bbls.

Maximum effective rate, March, 1942: 1515 bbls.

The early wells were drilled with cable tools. Many flowed sufficient oil between strings to pay for the drilling before the well was actually completed. Erosion has cut deeply into the Sespe red beds, making South Mt. the most scenic of all California fields .

Summerland pioneered this type of operations.

SUMMERLAND FIELD—

Location: 5 miles East of Santa Barbara (Santa Barbara County).

Discovery date: 1894.

Method: Drilled because of local show of oil on shore.

Geology

Type structure: Faulted monocline.

Age producing horizon: Lower Miocene and Oligocene—Vaqueros and Sespe.

Name Producing Horizon	Avg. Depth	Gravity
No definite zone—		
500 ft. of formation saturated	200-800	14-22

Character reservoir: Sand and sandy shale.

Development

Proven area: 180 acres.

Number wells: effective, 2; ineffective, 1; producing, 1. Total 4.

Depths: 200-800.

Deepest well: 5041. Sespe.

Production

1941: 4,559 bbls.

Total production to 1942: 3,158,472 bbls.

Avg. daily production during March, 1942: 17 bbls.

Maximum effective rate, March, 1942: 15 bbls.

Summerland was the first field in U.S. to produce oil in the ocean by drilling from piers. About 200 wells had been drilled by 1900 when a maximum production of 600 barrels per day was reported. Wells were 200-800 ft. in depth and rapidly went to water as oil pressure declined. After discovery of Elwood in 1928, exploration was revived and a number of small producers were drilled at the western end of the field. Production declined rapidly and development stopped. Storms and high waves have wrecked and washed away the wooden piers so that the present production is obtained from few wells on the banks adjacent to the shore.

VENTURA AVENUE FIELD—

Location: 2 miles north of Ventura (Ventura County).

Discovery date: Sept., 1916, by State Cons. Oil Co., Lloyd No. 1.

Method: Drilling on anticline.

Geology

Type structure: Elongated anticline.

Age producing horizon: Pliocene.

Name Producing Horizon	Thickness	Avg. Depth	Gravity
Gosnell-Lloyd ...	500	2600	24
Edison	1200	6600	
Fifty-Seven	600	8800	to
Lloyd	1000	10,100	. 32

Character reservoir: Sand.

Development

Proven area: 1840 acres.

Number wells: effective, 62; ineffective, 13; producing, 392. Total, 467.

Depths: 2400-11,000.

Deepest well: 11,146, Piocene.

Production

1941: 12,873,142 bbls.

Total production to 1942: 238,660,000 bbls.

Avg. daily production during March, 1942: 31,983 bbls.

Maximum effective rate, March, 1942: 51,000 bbls.

Gas seepages in the vicinity of the anticline axis crossing Ventura River attracted attention of operators who after great difficulties with high pressure gas brought in Lloyd No. 1. Drilling has continued to extend the areal limits and find deeper sands which are still of Pliocene age. The productive area extends along the axis for six miles which classes Ventura as one of the largest producing structures of the state.

North Coastal Fields

The North Coastal Fields are located in San Mateo and Santa Clara Counties, around the edge of a mountain range which extends southward from San Francisco to the mouth of the Salinas River. The area may be considered as a faulted geo-anticline with a core of serpentine and schistose rocks. Cretaceous and Tertiary beds dip away from the central uplift at high angles and considerable faulting is in evidence. Seepages and exposed oil sands are found in the Monterey shale in many places.

The three fields are the result of structural and sedimentary features of the region and it is quite possible that some additional production may be found, as a result of careful exploration.

SARGENT FIELD—

Location: 6 miles south of Gilroy (Southern Santa Clara County).

Discovery date: 1886, by Bradley V. Sargent.

Method: Drilling near seepage.

Geology

Type structure: Anticline.

Age producing horizon: Miocene-Monterey Shale.

Avg. Depth	Gravity
1400-1600	16-22°

Character reservoir: Sand.

Development

Proven area: 60 acres.

Number wells: effective, 1; ineffective, 0; producing, 8. Total, 9.

Depths: 900-1800.

Deepest well: 3583 Franciscan (?)

Production

1941: 9,055 bbls.

Total production to 1942: 315,186 bbls.

Average daily production during March, 1942: 24 bbls.

Maximum effective rate, March, 1942: 27 bbls.

The Sargent Field is a faulted anticline in Monterey shale, which is exposed over a considerable area. Development was started in 1886 because of numerous seepages and reports indicate that at one time about fifteen wells were in existence. The oil occurs in a sandy phase of middle Monterey shale where fracturing is usually severe. The Watsonville Oil Co. is the sole operator and ships approximately a thousand barrels of oil per month.

HALF MOON BAY FIELD—(San Mateo County).

Location: 25 miles south of San Francisco.

Discovery date: 1880, by T. B. Wilkensen.

Method: Drilling near seepage in Purisima Creek.

Geology

Type structure: Minor folds and faults on Monocline.

Age producing horizon: Pliocene (Purisima).

Avg. Depth	Gravity
1150-2420	30-54°

Character reservoir: Sand and fractured shale.

Development

Proven area: 80 acres.

Number wells: effective, 2; ineffective, 11; producing, 0. Total 13.

Depths: 700-2500.

Deepest well: 8007.

Production

1941: 614 bbls.

Total production to 1942: 41,477 bbls.

Avg. daily production during March, 1942: none.

Maximum effective rate, March, 1942: 2 bbls.

Some twenty scattered wells have been drilled during the past sixty years and nearly all show a light gravity oil with a high gasoline content. A few of these wells are still capable of small production with large quantities of water. During the last ten years well directed exploration has resulted in the discovery of light gravity oil but as yet is not sufficient in volume to be considered commercial.

LOS GATOS-MOODY GULCH FIELD—

Location: 5 miles south of Los Gatos (Santa Clara County).

The famous Little Star No. 4, in Pico Canyon, which D. G. Scofield and Alex Mentry drilled to a depth of some 600 feet more than 60 years ago This pioneer California oil well has produced steadily since it was first sunk into the rugged Southern California mountainside, back in 1879.

Discovery date: 1865.

Method: Drilling near seepage.

Type structure: Faulted Monocline.

Age producing horizon: Eocene (?)

Name Producing Horizon	Avg. Depth	Gravity
Several oil zones reported ...	1100-1300	22-26°

Character reservoir: Sand.

Development

Proven area: 20 acres.

Number wells: effective, 0; ineffective, 13; producing, 0. Total 13.

Depths: 1000-1300 ft.

Deepest well: 1880.

Production

1941: 2,613 bbls.

Total production to 1942: 59,531 bbls.

Avg. daily production during March, 1942: none.

Maximum effective rate, March, 1942: none.

This area is of interest principally to geologists because oil occurs low in the stratigraphic section. There is a possibility that the oil might have migrated from Cretaceous to the overlying San Lorenzo beds. The more recent view is that the oil is of Miocene age, having migrated across a fault to its present position. The wells belong to the stripper class and at the present time the field produces about 200 barrels per month, some four or five wells producing intermittently.

Several wells drilled near Los Gatos have obtained gas, none of which is yet commercial.

The Effect of Camouflage Painting on the Temperature of Plant Equipment

Presented at the August Meeting of the California Natural Gasoline Association

By

Oliver W. Johnson
Engineering Department
Standard Oil Co. of California

In preceding papers you have heard about the materials employed in gasoline plant construction, and about the role that paint plays in protecting and preserving plant equipment. There is another use of paint of which we have just recently become aware. We have all seen the results of this use as we drive past airplane factories, and some other industrial plants in this region. This use is in protective concealment, less accurately and more generally referred to as camouflage.

We all know that in the past, light colored paints have been almost universally employed for gasoline plant and oil refinery equipment. This choice has been based in part on appearance, and in part on the general belief that light colored paints decrease the amount of heat absorbed from the rays of the sun, and so reduce the temperature of the equipment. We also know that camouflage paints are usually dark in color, and we may have suspected that to change to these dark colors might increase the heat absorption. On the other hand, many of you have heard something of a new kind of paint, about which it has been said, "At the present, there are obtainable all colors and shades of paint which still retain the ability of aluminum paint to deflect the sun's rays but which render the plant very inconspicuous." Perhaps you have wondered how such statements fit in with our previous notions. In any event, I think you will agree that this question of heat absorption of painted surfaces is of sufficient interest to warrant a little serious consideration.

In outlining the present discussion, considerable difficulty was experienced in developing a logical and simple method of approach. Any treatment of camouflage is incomplete without mention of the use of infra-red reflective paints. Understanding of the properties of infra-red reflective paints requires a review of the nature of sunlight, the laws of reflection and the significance of color. Heat absorption is related to color. The choice of colors and types of paints depends on an understanding of the basic principles of camouflage. These related subjects seem to pursue one another around in a circle, and to offer no vulnerable point of attack.

Perhaps the least interesting, but most sound, method of approach is to consider the basic facts first. Let us, then, review briefly what we know about sunlight, and what becomes of the energy which it brings to the earth's surface.

In the interest of simplicity, we will ignore such complications as absorption bands in the solar spectrum, and consider sunlight to be simply a mixture of a large number of different wave lengths and colors, in the proportions which give to the eye the sensation of white light. We know that by means of a prism sunlight can be broken up and the rainbow colors red to violet separated one from the other. We also know that there are other components in normal sunlight which the eye cannot see. Very short waves, shorter than violet, and hence called the ultra violet, are invisible. They are very active chemically, and are responsible for the growth of plants, and largely for the effect of sunlight on the human skin, known as sunburn. Invisible ultra violet rays are sometimes used to excite fluorescence in certain minerals, which have the peculiar property of receiving the invisible "black light" rays and converting them into visible light.

At the other end of the spectrum are other waves, longer than the red, and hence called the infra-red, which are also invisible. The infra-red rays are capable of affecting certain specially treated photographic plates. They are sometimes called heat rays, because they are akin to the radiant energy given off by a heated body such as a steam pipe. However, we must be careful not to let this name mislead us. These so-called heat rays are not necessarily better carriers of heat than other rays. The name is derived from the fact that they have no other conspicuous properties.

A substance which does not transmit light is said to be opaque, and such materials are used as the pigment or light-stopping medium in paints. When the sun's rays strike a painted surface, part will be reflected and part absorbed. The absorbed part is always converted into heat.

The pigment employed in a paint gives to the painted surface the light reflecting and absorbing characteristics of the minerals of which the pigment is made up. When several minerals are present the property of the pigment is a composite of the properties of the components. This subject becomes quite complex when dealing with colored pigments, and we could avoid it entirely were it for for this question of infra-red reflectivity which we have set out to clarify.

A white substance is by definition one which reflects equally all the light rays which reach it. The commonly used white pigments, consisting of the oxides of lead, zinc and titanium, are truly white, in that they reflect not only the visible rays but also the invisible infra-red rays. In other words, these pigments are infra-red reflective although this expression is not generally employed when referring to white pigments. The important point is that a white surface reflects all of the rays which strike it in equal proportion, so that the quality

of the light reflected remains unchanged. A white surface will usually reflect up to 70 percent of the radiation received. We will avoid consideration of polished metal surfaces, which have special properties.

A truly black substance absorbs practically all of the radiant energy which it receives. The absorbed energy is converted into heat. Lampblack and most other common dark pigments are truly black, absorbing both the visible and invisible rays.

Since neither the common white nor the common black pigments show any selective absorption in the infra-red region, it follows that the common gray paints, made by mixing white and black pigments, will reflect the infra-red in about the same proportion as they do the visible rays.

Colored pigments convey to the eye a sensation of color, because instead of reflecting all wave lengths equally they reflect some one wave length more than the others. The light not reflected is, of course, absorbed, hence it follows that any colored pigments when exposed to the sun's rays must absorb more energy than a white pigment and, consequently, **must be warmer.**

In the same way that some colored pigments reflect some of the visible rays more strongly than others, it has been found that certain colored pigments also reflect the invisible infra-red rays more strongly than others. For example, while some green and brown pigments absorb almost all of the infra-red light which strikes them, others of similar visible color are quite reflective to the infra-red. As ordinarily employed, the expression, "infra-red reflectivity," means that the pigment reflects a higher percentage of the infra-red than it does of the visible light. This property is not visible, and must be revealed photographically or by photometric measurement. The significance and importance of infra-red reflectivity as applied to camouflage are best illustrated by an example.

First let us briefly review the part which paint plays in camouflage. We all know that, when we look at an aerial photograph or map, certain things stand out much more conspicuously than others. Some of these things, such as rivers, lakes, woods, bays, etc., are natural objects. Others, such as buidings, roads, plowed fields, etc., are man-made, and are conspicuous because of color, shape or regularity of pattern.

From a military standpoint any object conspicuous from the air may be important, either because it may be a possible target itself, or because it may serve as a landmark to assist the flier in locating military targets. The object of camouflage is to render such objects inconspicuous. For man-made objects, one of the most obvious ways to do this is to destroy color contrasts by the use of paint. Because light colored objects seldom occur in nature, it usually follows that one of the first steps in camouflage is to "tone down" light objects with dark paints. It is the effect of this use of darker colors which we wish to investigate.

Suppose, for instance, that we desire to camouflage a white building located in a park. The building is probably already partly sheltered by trees, so that its outline is somewhat concealed, but the light color stands out sharply against the green surroundings. One obvious solution of the problem would be to paint the building green to match the trees. Since foliage, because of the depth and shadow, always looks dark green at a distance, we would choose a dark green color, and could thus achieve almost complete concealment from visual observation.

There is another thing which must be considered, however. The camera is almost invaluable for aerial observation, because it records details which the eye cannot see in the limited time available in actual flight, but which can be discovered when the pictures are studied at leisure. Furthermore, because the photographic film has different properties than the human eye, it may record things which the eye cannot see at all. For example, if a film sensitive to infra-red radiation is used, together with a filter to exclude most of the visible light, it is possible for the camera to see the landscape in terms of the invisible infra-red rays, and thus bring out contrasts between different objects which the eye fails to see.

It happens that foliage in general is reflective in the infra-red region. If our house were painted with ordinary pigments which do not reflect infra-red, it would stand out in the photograph made with infra-red sensitive film as a dark object among light colored trees. Such camouflage would be a failure. The solution is to employ paints which will photograph the same as the trees do, and this property is achieved by proper combination of pigments in the so-called infra-red reflective paint.

Do not think that any one such paint is the answer to all problems. If the building to be concealed were located in an area of bare ground, which absorbs the infra-red, the use of infra-red reflecting paint would result in a photograph showing a white buiding in a dark background. This again is not good camouflage. The paint must match the surroundings not only in visible color, but also in the way in which it reflects the invisible infra-red rays, as shown by the camera. That, in its simplest terms, is the answer to the question of when to use infra-red reflective paint. The only way to tell when infra-red reflective paint is required is to determine the character of the terrain photographically.

Please do not let this very brief discussion lead you to believe that paint is the only thing to be considered in camouflage. Such is far from the truth, but a more comprehensive review of the subject is outside of our present problem. It has been necessary to emphasize the use of paint in camouflage in order to understand why the term infra-red reflectivity has suddenly become of such importance.

The next question we wish to take up is that of the heat absorp-

tion of painted surfaces. Some results of actual tests will presently be given, but in order to understand the true significance of the figures, we must again go back to fundamentals, and consider what happens to the energy of the sun's rays when they strike an object on the earth.

For a simple example, let us consider a black painted metal plate lying on the ground under the open sky.

At night, assuming the sky to be clear, this plate (as well as other objects on the earth) will be radiating heat into space. Under usual conditions we might expect to find the plate some eight degrees cooler than the surrounding air. Heat will flow from the air to the plate, and in all probability the plate will accumuate a coating of dew, because the air in contact with it will be cooled below the dew point.

When the sun rises and its rays strike the plate, they will be absorbed and their energy converted into heat. The temperature of the plate will rise, and it will presently become warmer than the surrounding air. The direction of heat flow will be reversed, and heat will now be transmitted from the plate to the air above it.

The heat which the plate receives from the sun can be dissipated in only three ways:

(a) by radiation to space.

(b) by conduction to other objects with which the plate may be in contact.

(c) by convection to the air above.

Experience proves that the first two effects are relatively minor. For any set of conditions an equilibrium is quickly established wherein the heat lost to the surroundings just balances the heat being received. Since convection to the air is the most important mechanism by which heat is carried away, and since convection is an approximately linear function of temperature differences, it follows that the difference in temperature between the plate and the surrounding air is a fairly accurate criterion of the amount of heat being carried away, and hence also of the amount of heat being received.

As the sun rises in the sky and looks more directly at the plate, the rate of heat input will increase, and this will be accompanied by a rise in temperature. If a cloud should interrupt the flow of heat from the sun, the temperature of the plate would promptly fall. If the rate of heat input is raised by turning the plate, so that it is at right angles to the sun's rays, the temperature will rise until a new equilibrium is established. The difference in temperature between the plate and the surrounding air is always a measure of the rate of heat absorption.

The principles just described have been found to provide a very satisfactory means of measuring the relative reflectivity of painted surfaces to the rays of the sun. Small metal plates are mounted on a backing of insulating board, so that they can all be directed toward the sun at the same angle, and so that the heat loss from their back surface will be approximately equal. When painted with various colors, each plate will assume a temperature proportional to its heat absorption. The temperature difference between the plate and the surrounding air, as measured with a thermocouple soldered to the back of each plate, furnishes a direct simples means of determining which plate absorbs the most heat. If a black and white plate are included in the test along with other colors, it is easy to relate the amount of heat absorbed by the colors to that absorbed by either the black or the white plate by simple proportion, and these ratios will be largely independent of minor changes in atmospheric conditions.

Table I gives the results of heat absorption tests made by the writer during May and June, 1942, in which several camouflage paints were included. The colors are described approximately by reference to the nine standard camouflage colors designated by Specification T-1213, Corps of Engineers, U. S. Army. Two coats of each paint were applied to chemically cleaned steel plates, and the surfaces were allowed to dry thoroughly before making measurements. The surfaces were, however, not weathered, and no attempt was made to draw concusions as to durability.

In analyzing the results the aluminum was arbitrarily chosen as the standard, and assigned a coefficient of one.

On this basis, the white surface, which absorbs less heat, has a coefficient of .8, and the black, which absorbs much more, a coefficient of 2.9. The other colors lie between, more or less in the same order as the darkness of tone as judged visually. Attention is directed particularly to the fact that there are no colors which have absorption coefficients nearly as low as the aluminum. Even the light gray absorbs 50% more than the aluminum, and the greens and browns, similar to those ordinarily employed for camouflage, all absorb two or more times as much as the aluminum.

What is the effect of the infra-red reflectivity?

You will note that certain of the colors are designated as infra-red reflective. This statement of the manufacturer probably simply means that as much infra-red reflecting pigment had been incorporated as was possible, consistent with obtaining the desired color. Tests made by the National Paint, Varnish and Lacquer Association (Circular 638) show reflectivities of 10% to 52% in the near infra-red range (wave lengths 740 to 890 mu) for typical camouflage paints, probably similar to some of those in the above table. In spite of this, the dark colors absorbed more heat than the light ones. This simply emphasizes the obvious fact that temperature is the result of absorption in all wave lengths. Only a portion of the sun's energy is in the infra-red. Since any dark color must absorb a considerable proportion of the visible light in order to appear dark and colored,

Table I. Relative Heat Absorption of Painted Surfaces

Color	Rise Above Air Temp. Deg. F.	Ratio
White	25	.8
Aluminum	31	1.0
*Light grey	45	1.5
*Medium grey	54	1.7
*Light green, approx. No. 2	63	2.0
*Green, between No. 2 and No. 9	63	2.0
*Green, between No. 2 and No. 9	65	2.1
*Earth red, darker than No. 8	72	2.3
*Earth brown, darker than No. 4	74	2.4
Dark green, darker than No. 9	85	2.7
Black	90	2.9

*Paints said to be infra-red reflective.

it seems likely that this effect will quite overshadow what occurs in the infra-red. Of course, if two paints have exactly the same color and tone as judged visually, we would expect the one having the highest infra-red reflectivity to be the cooler, but even a small difference in visual color might overcome this advantage.

The whole question of the proper field of usefulness of infra-red reflective paints may be summed up by saying that the major object of using them is to achieve a proper photographic match with the surroundings. If the surroundings require it, such paint should be used. If they do not require it, the disadvantage from the standpoint of camouflage will more than offset any minor advantage from lower temperature.

It is of interest to note the temperature differences observed and recorded in the table. These temperatures represent the probable maximum rise above air temperature for objects painted as indicated and exposed normal to the sun's rays, assuming the objects to have low heat capacity, and no means of cooling other than natural convection to the air. The figures were obtained under average coast conditions of wind and atmospheric humidity. They will undoubtedly be exceeded slightly during periods of dead calm or extremely clear atmosphere.

Actual objects, such as tanks, which have a high heat capacity, do not ever reach equilibrium conditions. Small objects, such as pipes, may quite readily approach the temperatures indicated. A pressure of over 2000 lb./sq. in. can easily develop in a closed length of liquid filled pipe as a result of the heat of the sun. The power of the sun's rays cannot be ignored.

Paint offers one of the most important ways we have for modifying the effect of the sun's rays. If a color darker than white or aluminum is employed, an increase in temperature is bound to result. In some cases an increase in the temperature of gasoline plant equipment will do no harm. In others, it will result in an increase in evaporation loss, which can be important but not vital. In some few cases even a small increase in temperature may be very important, as, for example, where a vessel is operating close to the relief valve setting. The plant engineer must be able to predict the effect of temperature rise in any part of the plant if unexpected results from camouflage painting are to be avoided.

To summarize the points covered in this brief discussion we may say:

1. The use of dark camouflage colors instead of white or aluminum is likely to increase by at least twofold the heat absorbed from the sun's rays.

2. The temperature increase which results will depend on the nature of the equipment. The effect of the increase will depend on circumstances which must be evaluated independently for each part of the plant.

3. The property of infra-red reflectivity in camouflage paints makes it possible for a painted object to match **certain types** of surroundings both visually and when photographed with filter and infra-red sensitive film.

4. The principal justification for the use of infra-red reflective paints arises from the photographic quality of the paint as compared to that of the surroundings, and to employ such paint where not so needed would yield only a minor advantage in decreased temperature, but would largely defeat the object of camouflage.

Static Defense of Strategic Oil Installations, by B. Orchard Lisle—Scribner's Technical Book Dept., 597 Fifth Avenue, New York, N. Y. Price $1.00. Preventative construction and protective concealment are the two phases of static defense dealt with by this little manual. Designed in a format for convenient insertion in engineers' loose-leaf reference books, it contains 11,000 words of pertinent information based primarily on experience of oil men in war-torn Europe, in addition to contemporary American researches. There are numerous photographic illustrations of both camouflaged and underground installations, while there also are many drawings and charts as well as tables showing bomb types, functions, and relative effectiveness and the degree of protection required against them. In the text, the natures of both incendiary and demolition bombs are described, their effects analysed, and precautions in construction and maintenance before air attack to reduce the hazard are given in the first half of the manual. The second half is devoted to the question of camouflage and total concealment.

In order to complete our wartime merchant ship program we shall have to turn out an average of three ships a day during this year and the next.

Ten thousand tons of steel went into the metal tops of the 1,000,000 jars manufactured last year to hold cold cream and other cosmetic products.

An average chair contains enough hardwood to make the stock of a Garand rifle.

(Continued from Page 20)

Agitation — Common to space between trays.

* * *

Metal	Pent. Ins. per year
Mild Steel	0.0500
Monel	0.0075
Nickel	0.0069
Yellow Brass	0.0240
18-8 Stainless	0.0254
Gray Cast Iron	0.0430 (90 days)
Ni-Resist Cast Iron	0.0131 (90 days)

Note: Corrosive considered to be hydrochloric acid generated from salts.

Table VII

Product—Naphthenic Acids in Distillate.
Temperature—554° F.
Location of Spool—Between trays in column.
Time—60 days.
Agitation—Common to space between trays.

* * *

Metal	Pent. Ins. per year
Mild Steel	0.0163
Monel	0.0012
Nickel	0.0006
Inconel	0.0007
18-8 Stainless	0.0236
18-8-3 Mo. Stainless	0.0020
16-13-3 Mo. Stainless	0.0009
Cast Iron	0.0082
Ni-Resist	0.0109

Inconel (80% Ni-13% Cr) and the molybdenum containing stainless steels are indicated for use. The temperature exceeds the 500° F. limit usually set for Monel and nickel to prevent sulfur attack.

A background of the theory bearing on this type of corrosion is offered with the thought that it might be useful in combating the attack. Certain locations exist where liquid water is absent and in these locations special alloys find application. Experience from petroleum refineries, especially from the gasoline recovery units, has been drawn upon in preparation of the paper.

G-E Men Discuss Emergency Overloading Of Power Transformers

Taking advantage of the maximum overload capacity of power transformers will provide additional electric power and take care of emergency conditions caused by electrical failure or sabotage.

This suggestion for getting the most out of existing power transformer equipment was made in a paper by V. M. Montsinger and P. M. Ketchem, of the General Electric Co., presented recently at the Summer Convention of the American Institute of Electrical Engineers, meeting in Chicago. They recommended that the problem of preparing emergency overloads be given immediate consideration by the A.I.E.E. Transformer Subcommittee of the Electrical Machinery Committee.

Emergency overloads considerably in excess of those given in the American Standards Association Guides for operation were found possible, based upon data obtained in the laboratory on the aging of insulation, and by use of the rule that for each 8 degrees Centigrade (14.4 F) the temperature is increased, the life of the transformer is halved.

The authors pointed out that while the practice of overloading transformers has been increasing during the past few years, the importance of taking advantage of maximum overload capacity is greater today than ever before. There are two reasons, they said:

"First, in many cases the demand for additional electric power has caught up with or even exceeded the present transformer capacity—when operated in the usual manner—and additional capacity is needed. A great many loading curves show that the load factor of most power transformers ranges from 50 to 65 per cent. A large reservoir of capacity is therefore available which could be used without causing a serious shortening of transformer life.

"Second, we now have the important problem of taking care of rare emergency conditions caused either by electrical failure or by a saboteur. In the past it has generally been considered necessary to carry a spare transformer or a spare bank of transformers to pick up the load in case of a failure. Today many users are considering the use of, and are relying on, the short-time overload capacity of their transformers to carry them through rare emergency conditions. In fact, under some conditions it may be economical and necessary to use up 25 per cent, 50 per cent, or more of the transformer life to prevent a shutdown."

To do this intelligently requires reliable information on how to calculate hot-spot temperature, and how the life of the transformer is affected by heavy overloads. The Montsinger-Ketchum paper was devoted to a discussion of that problem.

The authors reported that approximately 50 heat runs were made during the past year on three transformers of different ratings. These heat runs provided accurate data on: (1) the value of the hot-spot temperature in various classes of transformers at rated load, and (2) a practical method of calculating the hot-spot temperature with changes in the load under both ultimate and short-time overload conditions.

The rate of deterioration of insulation in a transformer is governed by the hot-spot temperature in the winding, they said, although quite often factors other than the life of the insulation limit heavy overloads for transformers. Among such factors are contacts, leads, joints, and oil. Effect of heavy overloads on regulation must also be carefully considered.

The following general conclusions on steady state and transient temperature rises were presented:

1. For rated load conditions of self-cooled power transformers, the hot-spot rise over average winding temperature by resistance ranges from approximately 5 C. upwards. For moderate size and voltage ratings (below approximately 50 kv) it naturally comes between 5 and 6 degrees. But, for large size and high voltage ratings, steps have to be taken by the designer to limit the hot-spot to 10 C. above average.

2. For transformers having an OAP rating 1.33 times the self-cooled rating, the hot-spot rise over average winding temperature is approximately 40 per cent greater than that for the self-cooled rating.

3. The hot-spot rise over average winding temperature increases with load (for both ultimate and short-time overloads) but no definite rate of rise versus load can be stated.

4. The average winding rise over average oil varies as the loss raised to a power ranging from 0.6 to 0.7.

5. The hot-spot rise over top oil varies as the loss raised to a power ranging from approximately 0.7 to 0.8, generally more nearly the 0.8 power for most transformers.

6. The oil time constant used in calculating the temperature rise of the oil for short-time overloads should be based on the ultimate rise and loss for rated load conditions.

The winding time constant used in calculating the temperature rise of winding over oil before conditions become constant, should be based on the calculated ultimate rise and loss for the load under consideration.

8. Either loading-back or short-circuit method of loading can be used to determine both hot-spot and average winding temperatures. When calculating the transient oil rises by equation, for the short-circuit method the weight of the core should not be used in deriving the time constant.

9. The temperature rise of both the average and top oil varies approximately as the 0.8 power of the loss for ultimate conditions.

Field Development

Los Angeles Basin

Barnsdall Gets Good R. S. F. Well

Barnsdall Oil Co. completed Rancho San Francisco No. 29 in the Newhall-Potrero field flowing at 1450 bbls. of clean 33.9 gravity oil and more than 900,000 cu. ft. of gas through a half-inch bean from 7553 ft. Other company development within proved limits is No. 21 at 486 ft., No. 30 at 3444 ft. and No. 32 at 1041 ft. The company is also scheduling two additional wells in the extreme southeast section of the field which was recently demonstrated producible.

At the northwest tip of the field The Texas Co.'s outpost, Newhall No. 1, is spot coring at 7042 ft. in search of field sands.

Western Gulf Cores Oak Canyon Well

Western Gulf Oil Co. is coring for pay in its current Oak Canyon well, Gilmour-U.S. No. 2. Last reported at 6835 ft. the well is expected to be followed by several more projects to properly develop the comparatively new field.

Shell Starts Puente Play

Shell Oil Co., Inc., is preparing to drill Garnier No. 1 near the center of the northeast quarter of sec. 33, 1s-10w in the Puente area of Los Angeles county. The site is reported to be on a structure long considered promising by many geologists.

To the south in Orange county the companys' extension program at the north flank of the Yorba Linda field is under way with the first effort, Olinda Fee No. 4-77-16 bailing for production at 2040 ft. and the second, No. 55-16, drilling at 351 ft.

Turnbull Canyon Well Makes Good Pumper

Continental Oil Co. made a substantial pumper of Turnbull Community No. 3 on sec. 13,2s-11w. Originally drilled to a barren 5608 ft. after drilling out of the fault block, the well was directionally redrilled to 3801 ft. and finished on the beam for a 340 bbl. rate of 22 wet gravity oil cutting 27% on a 16 hour gauge. Last production was 295 bbls. of 24.5 gravity oil cutting 8.9%.

Wilmington Work Lags

Activity in the Wilmington field is at the lowest ebb in its history with only six strings working. Many projects are sechduled but for manifold reasons are being delayed.

In the Long Beach Harbor section of the field D. D. Dunlap & Jonah Jones, Jr., are rigging up on Cerritos No. 2 and Long Beach Oil Development spudded Nos. 34, 37 and 40 on the "W" parcel at the ocean front. Oil Investments, Inc. is rigging up

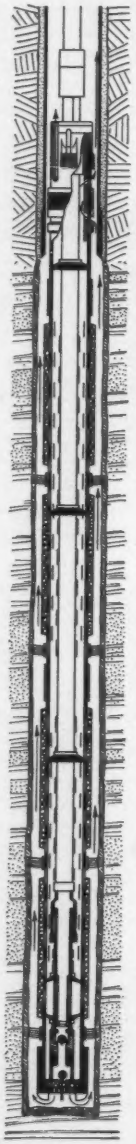
LOS ANGELES BASIN WILDCATS

Area	Well	No.	Section	Depth	Status
Castaic	The Texas Co., Towle	1	3,4-17	4632	Drilling
	Young, Roy W., Inc., Walker	1	11, 5-16	9981	Fishing D. P.
Las Llajas	West'n. Gulf O. Co., Brady	1	13-3-17	395	Drilling
Newhall	James C. Brazell, Trustee, Perkins	1	11, 3-16	4443	Testing
Puente	Shell Oil Co. Inc., Garnier	1	33,1-10		Location
Puente Hills	Continental Oil Co., Turnbull	3	13, 2-11	3801	Completed
	Melvin Hansen, Dragna	1	24, 2-10	2230	Cleaning Out
Rio Hondo	Potrero Oil Co., Newman	1	32, 1-11	5430	Idle
San Fernando	Fernando Oils, Ltd., Chatsworth	1	18, 2-16		Rig
	Tide Water Assoc., Sesnon	1	28, 3-16	8912	Redrilling
Whittier-La Habra	Los Nietos Valley Oil Co., Woodward	1	29,2-11	2519	Drilling
	Orange County				
Anaheim	The Texas Co., Buena Park	4E-1	36, 3-11	10,044	Flowing
Bolsa Chica	La Bolsa Ro. Synd., Crane	1	22, 5-11	7310	Idle
Kraemer	Hamilton & Sherman, Kramer	3-2	31,3-9	5010	Drilling
Costa Mesa	Thompson, Milton N., Banning	1	9, 6-10	5649	Idle
Yorba Linda	Shell Oil Co., Orlinda Fee No. 4.	55-16	16,3-9	351	Drilling
	Shell Oil Co., Orlinda Orlinda Fee No. 4	77-16	13-3-17	2040	Completing
	San Bernardino County				
Carbon Canyon	Stella, E. F., McDermott	2	5,3-8	210	Idle
	Union Oil Co., Newman Bros.	1	2,3-8	4868	Abandoning

SECURE MAXIMUM PRODUCTION

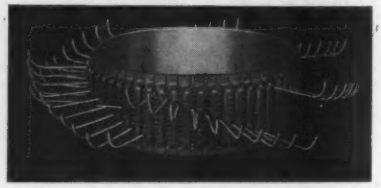
By Using the B and W Completion Method on Your Well

The diagrams at left and right illustrate how the B and W Completion Method removes that mud sheath which prevents free entry of oil and gas into your well. Positive mud removal is accomplished when setting either gravel packed or perforated liners. The vital part of this method is the use of . . .



B and W, Inc.

WALL CLEANING GUIDES



Only one trip into the hole is needed to remove the mud from behind the liner, land the liner, wash the gravel pack or perforations, and prepare the well for production.

Bailing and Swabbing Greatly Reduced . . .

No costly bailing time is required for pumping wells—and very little swabbing is necessary for flowing wells. In a recent case a well was brought in by the B and W Completion Method after only 7 HOURS swabbing—an offset well using conventional methods required over 4 DAYS.

Wells "Clean Up" Quickly . . .

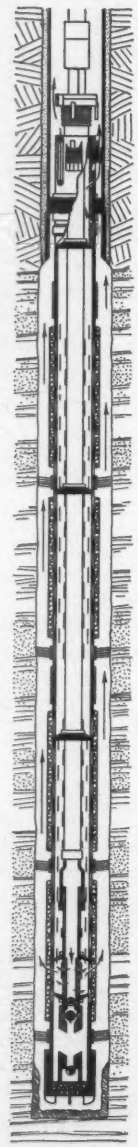
There is a quick change from wash fluid to clean, mud free oil when the B and W Completion Method is used—your walls are clean—your gravel pack is clean—and your liner is free from mudded-off or plugged perforations.

Get the Facts . . .

from your nearest B and W office. Let them explain also why B and W Gravel Pack Set Shoes (as illustrated)—for use with gravel pack or perforated liners—will never allow sand entry, or be broken while bailing.

» » »

Left: Removing mud from behind liner.
Right: Showing liner set and gravel pack or perforations being washed.



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to redrill Advance Truck No. 4 while Union Pacific Railroad is swabbing for production after completing its casing program to 4303 ft. in No. E-40.

In the closely allied Northwest Wilmington-Torrance area The Texas Co. is drilling Oakley No. 7 in the grass roots after receiving OPC approval of the job.

Kraemer Well Cores Oil Sand

Hamilton & Sherman's Kraemer No. 3-2 in sec. 31, 3s-9w of the Richfield-Kraemer area, is drilling ahead in oil sand and shale at 5102 ft. Core recovery has been poor in this job with only one good core out of many. As a consequence the top of the zone was not accurately placed but the drilers log indicated that the main Kraemer, or objective sand, has not been reached. The operators will drill to bottom and run electric log for sand zone examination without further cores.

Castaic Well Cores Oil Sand

The Texas Co.'s Towle No. 1, on sec. 3,4n-17w in the Castaic area, is going ahead in shale at 4632 ft. after field reports indicated that the well had cored interesting quantities of heavy oil sand. To date the operator has made no claims of success. Roy W. Young yet fishes drill pipe in his 9981 ft. Walker No. 1 in sec. 11,4n-16w. In the Las Llajas Canyon area Western Gulf Oil Co.'s Brady Estate No. 1, on sec. 13,3n-17w, is having trouble with lost circulation at 395 ft. and is preparing to set surface casing.

Union Oil Quits San Berdu "Cat"

Union Oil Co.'s Newman Brothers No. 1 in the Carbon Canyon area of San Bernardino county is going on the hook at 4868 ft. after bottoming in gray sand and shale. The well, in sec. 2,3s-8w, was bridged at 330 ft. and equipment is being removed. Owing to the controversial formations encountered no geologic age has been released pending further examination of the cores.

San Joaquin Valley

E. A. Parkford Spurs South Belridge Work

E. A. Parkfords development of his newly discovered heavy oil production off the southerly tip of the South Belridge field is proceeding rapidly. The play, near the center of sec. 12,29s-21e, currently comprises five wells with the first three already on production pumping an average 90 bbls. each of 14 minus gravity oil cutting some 15 percent sand. The fourth is completing at 1105 ft. and is rated as a sure fire addition to fuel oil reserves. The operator will spud the fifth well at once.

Paloma Outpost Running Deep

General Petroleum Corp.'s Gallagher No. 61-33, in the northeast quarter of sec. 33,31s-26e, is drilling in hard shale at 10,748 ft. Located approximately a mile north of Paloma field production, the well appears to be running very low structurally. No announcement has been made concerning the well's exact position in the geologic column.

Two Work At Devils Den

R. S. Meisse, an individual operator, and Devil's Den Oil Co. are the sole current operators in the Devil's Den area of Kern county. The former's McCalden No. 1, in the NW¼ of the NE¼ of sec. 26, 25s-18e, is reported at 190 ft. while the latter's McCalden No. 2, in the SW¼ of the NE¼ of the section, is turning to the right at 515 ft. in hard shale. The wells are expected to finish typically with shallow substantial production yielding good crude for lubrication oils.

Tide Water Starts McFarland Area Well

Tide Water Assoc. Oil Co. is starting immediate work on well No. 32-15 some 990 ft. south and 1650 ft. east of the NW corner of sec. 15,26s-26e, about three miles east of the town of McFarland in northern Kern county. The area has been previously drilled on three sides at distances a mile removed from the present site but to date has not been tried at depth.

Tide Water Finishes Wagonwheel Zone Well

Tide Water Assoc. Oil Co. finished well No. 35 on sec. 21,27s-20e in the North Belridge field at 8570 ft. With the Wagonwheel zone open the well initiated 589 bbls. of clean 31.5 gravity oil and 576,000 cu. ft. of gas through a 24/64 in. bean under 150/2900 lbs.

Lytle Suspends Guijarral "Cat"

Robert S. Lytle, Operator's wildcat No. 68-28F, in sec. 28,20s-16e south of the Coalinga Eocene Pool, is standing suspended after bridging at 1150 ft. Bottomed at 11,586 ft. in Cretaceous the well found showings of moderate saturation in the upper Eocene at 9420 ft. Tests of the 20 ft. sand body were mechanical failures on the original drilling and a 7 in. stub liner was cemented for further trial. Unable to reenter the liner for perforating, the operato plugged to 8875 ft. and redrilled to again try the sands, an operation which failed when the bit drifted in-

SAN JOAQUIN VALLEY WILDCATS

Area	Well	No.	Section	Depth	Status
	Fresno County				
Burrel	Gen. Pet. Corp., Noble	89-9	9,17-18		Location
Guijarral Hills	Lytle, Robt. S., Opr., Well	68-28F	28,20-16	11,586	Suspended
	Standard Oil Co., Well	82-29F	29-20-16		Rigging Up
Helm	Amerada Pet. Corp., Clover	75-34	34, 16-17	8223	Completed
	Amerada Pet. Corp., Hatch	F-41-2	2,17-17		Rigging Up
Jacalitos	Wilshire Annex Oil Co.	58-26E	26,21-13	3675	Drilling
	The Texas Co., Ferguson	1	32,21-16	4782	Drilling
Kerman	Richfield Oil Corp., Burns	1	30-13-17		Grading
Mendota	Pure Oil Co., C.L.G.	1	22,15-13	6003	Drilling
Raisin City	Shell Oil Co., Inc. S.A.&F.L.	53-19	19-15-18	5267	Drilling
Riverdale	Amerada Pet. Corp., Brum	58-15	15,17-19	6840	Completing
	Amerada Pet. Corp., Young	4-15	15,17-19	6883	Drilling
	Amerada Pet. Corp, Courtney	4-23	23,17-19	6837	Drilling
	Amerada Pet. Corp., Jensen	52-26	26-17-19	6840	Completing
	Amerada Pet. Corp., Leal	F-21-26	26,17-19		Location
	Kern County				
Antelope Hills	Shell Oil Co., Inc., Williams	23-6	6,28-20	2709	Drilling
South Belridge	E. A. Parkford, Well	3	12-29-21	1102	Completed
	E. A. Parkford, Well	4	12-29-21	1105	Completing
Comanche Point	L. E. Barat Synd., Ham Johns	1	5,11-18	1604	Testing
Dyer Creek	Fred Jasper, Jr., Well	1	16,26-27	1935	Drilling
	Bolsa Chica Oil Corp., Clark	1	36,25-26		Rigging Up
Edison	M.T.M. Oil Co., Inc., Well	1	23,30-30	1589	Idle
Kern Front	Standard Oil Co., Well	42-9	9, 28-27	6211	Bailing
McFarland	Tide Water Assoc. Oil Co. well	32-15	15,26-26		Location
McKittrick	Americal Pet. Inc., Americal	1	2, 30-21	5450	Testing
	MacVee Assoc., well	1	33,29-21		Location
McKittrick Front	Westates Pet. Corp., Kimball	3	32, 29-22	1670	Suspended
	Westates Pet. Corp., Kimball	4	32,29-22		Location
Midway-NW.	C.C.M.O. Co., Well	24-1	1, 32-22		Rigging Up
Midway-SE.	The Texas Co., P.U.P.	2	33,11-23	4005	Drilling
Mt. Poso	Delaney, Fred G., Well	1	12. 27-27		Location
Paloma	Gen. Pet. Corp., Benco	87-28	33,31-26		Location
Paloma	Gen. Pet. Corp., Gallagher	61-33	33,31-26	10,748	Drilling
	West'n. Gulf Oil Co., L.A.C.	36-1	1, 32-26		Foundation
Poso Creek	Dolley & Dugan, Sesnon	1	17, 28-27		Location
Shale Hills	Tideland Oil Co., Grant Est.	1	4, 27-28	4064	Idle
	Kings County				
Alpaugh	Elmer C. vonGlahn, Well	1	4,23-22	8361	Drilling
Pyramid Hills	Pac. O. & G. Dev., West Slope	2	20, 24-18		Location
	San Luis Obispo County				
Midway, NW	C.C.M.O. Co., Thomas	1	1,31-21		Location
	Tulare County				
Pixley	Continental Oil Co., Reynolds	1	15,23-25	4622	Drilling

to the old hole and promoted suspension.

Gen. Pet. Starts Burrel Wildcat

General Petroleum Corp. is pouring foundation for Noble No. 88-9 in the Burrel area of Fresno county in search of another field. Located in the southeast corner of sec. 9,17s-18e, the test lies a mile east of the town of Wheatville and three miles southeast of Amerada Pet. Corp.'s Truman No. 4-6 which produces high gravity condensate and gas from the lower Eocene at 8020 ft.

Mendota Area Wildcat Drills Upper Eocene

The multiple company project which Pure Oil Co. is operating in the Mendota area of Fresno county is running electric log after penetrating the Domengine section of upper Eocene age. The well, C.L.G. No. 1 in sec. 22,15s-13e, is currently bottomed in sandy shale at 6003 ft. after marking the Kreyenhagen from 4534 to 5820 ft. and the Domengine in the interval 5825 to 5901 ft.

Raisin City Well Near Completion

Shell Oil Co., Inc.'s Santa Ana & Fresno Land No. 53-19, in sec. 19,15s-18e, is nearing completion in the fields continental Miocene beds after bottoming in claystone and streaks of oil sand at 5267 ft. Good oil sands were cored in the intervals 5035-5046, 5050-5060, and 5100-5235 ft.

Two Strings Work at Dyer Creek-Jasmine

Two operators are seeking production in the geologically complex east Valley area. In the Dyer Creek area Fred Jasper, Jr. is drilling at 1935 ft. in the NW¼ of sec. 16, 26s-27e in search of a saturated Vedder zone fault block. In the Jasmine section of the district Bolsa Chica Oil Corp. is rigging up to drill Clark No. 1 in the NE¼ of sec. 36,25s-26e on 240 acres recently acquired from Petromont Oil Corp. which retained the balance of its acreage.

Greeley Gets Good Producer

Production rates remain high in the Greeley field of Kern county. Latest to finish is Standard Oil Co.'s KCL No. 11-35 on sec. 18,29s-26e which finished at 11,510 ft. in the Vedder zone flowing 2522 bbls. of clean 35 gravity oil and 2,773,000 cu. ft. of gas through a 48/64 in. bean. Standard has two other wells nearing completion in the field.

Standard Pumps B. V. Hills Well

Standard Oil Co. marked up another Buena Vista Hills well completion when No. 83-27B on sec. 27, 31s-23e finished pumping 153 bbls. of 26.9 gravity oil from 3160 ft. The company is running tubing to complete No. 91-27B at 3113 ft. in the same section and is rigging up on No. 93-35B on section 35 of the township.

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Coastal District

Cat Canyon Work Yet Continuing

Development work in the Cat Canyon field area of Santa Barbara county is briskly continuing. Outpost development includes three projects while in the proved sections two units are proceeding.

Newest to schedule outpost trial is Bel-Air Co. which is rigging up Williams No. 1 in the southwest corner of sec. 25,9n-33w. Already under way is Standard Oil Co.'s South Basin-Lloyd Comm. No. 1 in sec. 15,9n-33w. This well is currently bottomed in Sisquoc age shales after encountering some oil sand and gray sand. A formation test at 4290 ft. of 135 ft. of zone noted a substantial rise of mud and heavy oil. On section 21 of the same township the company has rig up for Los Flores No. 5.

In the proved limits Pacific Western Oil Co.'s Los Alamos No. 18 is drilling in Sisquoc shale at 5609 ft. on sec. 1,8n-33w. On sec 35,9n-33w Union Oil Co. has built rig for Bell No. 15 and expects to start drilling soon.

Engineering, Technology, latest news—twice a month in California Oil World.

COASTAL COUNTIES WILDCATS

Area	Well	No.	Section	Depth	Status
	Santa Barbara County				
Cat Canyon	Alphonzo E. Bell Corp., Gilmore	1	23, 9-33	6457	Idle
	Bel-Air Oil Co., Williams	1	25,9-33		Rigging Up
	Standard Oil Co.	SBLC1	15-9-33	4795	Drilling
	Standard Oil Co., Los Flores	5	33, 9-33		Rig
Lompoc	Alphonzo E. Bell Corp.. Lompoc	6	28, 8-34		Grade
	Fickert Oil Co., Ltd., Well	1	8, 7-33		Rig
Los Olivos	Tide Water Assoc O. Co., Davis	1	33, 8-31	5055	Rng. Casing
Orcutt	Standard Oil Co., Rice Ranch	1	14,9-34	9120	Drilling
	Ventura County				
Bardsdale	Hopland Oil Co., Well	1	1, 3-19	4634	Idle
	Santa Marino Oil Co., Elkins	1	7, 3-19		Rig
	Ventura Southern Oil Co.	G-1	19, 3-19	5363	Idle
Conejo	Sycamore Oil Co., Boylan	1	23, 1-20	2687	Drilling
	L. A. Basin Oil Co., Well	1	4-1-20	1518	Idle
Eureka Canyon	Phillips & Nichols, Well	2	33, 4-18	667	Stdg. Cem.
Ojai	Coates, Spencer D., Pirie	5	7,4-22	982	Cleaning Out
	Kelalee Pet. Co., Harvey	1	8, 4-21		Rig
Oxnard	Royalty Service Corp., Leonard	1	19-2-22	3200	Drilling
Piru	Continental Oil Co., Holser	1	14, 4-18	4663	Pumping
	Delroy Pet. Corp., Fisk C. H.	1	22, 5-18	2629	Circulating
	Pac. West. O. Co., Temescal	13	4,4-18	3359	Drilling
	Tide Water Assoc. Oil Co., Hidden	2	5,4-18		Location
Sespe	Merchants Pet. Corp., Cochran	1	4-20	1585	Drilling
Timber Canyon	Crude Oils., Inc., West	1	19, 4-20	958	Idle
	Henderson-Ortez Oil Co., O'Leary	1	29, 4-20		Rig
Torrey Canyon	Union Oil Co., Torrey	60	5, 3-18		Location

NORTHERN COUNTIES WILDCATS

County	Well	No.	Section	Depth	Status
Colusa	Pacific National Pet. Corp.	1	17,17n-4w	1402	Idle
Contra Costa	Joseph Faria, Jr.	1	21-2n-1w		Rig Idle
Humboldt	The Texas Co., Holmes-Eureka	2	22-3n-1w	1295	Drilling
Madera	Blake, T. E., Chuck	1	28, 10s-17e		Rig Idle
	The Texas Co., Chowchilla	27-26	26,11s-14e		Spudding
Monterey	Loma Grande Oil Co., Corey	1	23,24s-10e	4318	Stdg. squeezed
	Wm. C. Jensen, Vierra	1	7-13s-2e		Rig
San Benito	The Texas Co., Henderson	1	33, 16s-12e	957	Drilling
	Union Oil Co., Friedman	1	13,16s-12e	1634	Drilling
San Joaquin	Standard Oil Co., Blewett Com.	3	23, 3s-6e		Rig
San Joaquin	Standard Oil Co. Woods Comm.	1	23,1n-5e	5254	Completed
Solano	Standard Oil Co. Fontana Farms	1	23,3n-1w		Location
	Standard Oil Co., Suisun Com.	1-2	36,4n-2w	2490	Drilling
	Standard Oil Co., Suisun Com.	2-1	25, 3n-1w	7300	Cementing
Stanislaus	Don Pedro Oil Co., Newman	1	9, 6s-9e	4074	Idle
Sutter	Buttes Oilfields Inc., Buttes	8	28, 16n-2e	5561	Idle
Tehama	The Texas Co., Walbridge	1	32,28n-2w		Location
Yolo	Tide Water Assoc. Oil Co., Woodland Comm	1-8	8,9n-1e		Rigging Up

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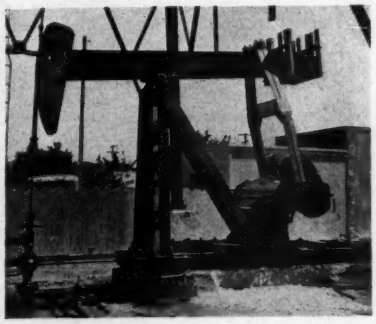

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Northern Calif. Gas Development Proceeds

The northern section of the state will be adequately supplied with fuel gas if effort on the part of California's oil operators is any guarantee. With two good completions already marked up for the week many projects still seek gas production.

The Texas Co. has scheduled a heavy program with four projects under way. In the Eureka area of Humboldt county the company moved east of production to drill Holmes-Eureka No. 2 on sec. 22,3n-1w where productive sands are believed to thicken. Last depth was reported as 1295 ft. In the Moffat Dome Area of Madera county Texaco seeks Cretaceous production on sec. 26,11s-14e of the Chowchilla Farms where No. 27-26 is preparing to spud and in Tehama county the company is preparing to drill the Tuscan Buttes area some 20 miles southeast of Red Bluff. Also a Cretaceous test, the well will be drilled on sec. 32,28n-2w, a portion of the Walbridge Estate. A fifth northern California project of Texaco's is Henderson No. 1, last reported at 957 ft. on sec. 33,16s-12e in the Ciervo area of San Benito county. Union Oil Co. also works the township with Friedman No. 1 on section 13 last reported drilling in hard shale below 1600 ft.

In Yolo county, Tide Water Assoc. Oil Co. is rigging up to drill Woodland Comm. No. 1-8 on sec. 8,9n-1e. Standard Oil Co., who effected the two latest completions, is drilling Suisun Comm. Nos. 2-1 and 1-2 and has located Fontana Farms No. 1 on Suisun Bay in the Fairfield area of Solano county. The company also has built rig for Blewett Comm. No. 3 in the Tracy area of San Joaquin county.

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Oxnard Test Below 3000 Ft.

Royalty Service Corp.'s Oxnard area try for heavy oil production, Leonard No. 1 on sec. 19,2n-22w, is coring hard gray sandy siltstone at 3200 ft. Dips from core recovery have been relatively flat with no showings reported to date.

New Locations In Santa Maria Valley

Hancock & Bush resumed their joint development program in the Santa Maria Valley field by announcing four new projects for immediate starting. The units are Brown No. 4, Hopkins No. 6, Rosenblum No. 4 and Wylie No. 5. First to spud will be the Hopkins well with Kern Drilling Co. already preparing equipment for the start.

Pacific Central Oil Co.'s Defense No. 1, on sec. 20,10n-34w, is testing water shut off on a combination 7 in. string landed at 4250 ft. and cemented through perforations at 4073 ft. Total depth is 4340 feet.

Union Oil Co.'s Bradley Lands No. 2-4 on section 6 is testing 7 in. casing water shut off after entering brown shale at 4780 ft. and bottoming at 5250 ft.

Rio Vista Gas Volume Swells

The Rio Vista gas field, which is expected to bear a large portion of Northern California's seasonal fuel gas load, was materially enriched when Standard Oil Co. completed Midland Fee No. 1-2 at 4275 ft. flowing 23,206,000 cu. ft. through a 7/8 bean. The well is shut in pending demand under 1676 lbs. pressure.

The company finished a 5,242,000 cu. ft. well in the McDonald Island area of San Joaquin county during the same period. This well, Woods Comm. No. 1 on sec 23,1n-5e, bottomed in gas sand at 5254 ft. after entering the zone at 5240 ft.

Santa Barbara Co. Wildcats Working

Two of the most interesting wildcats in the Coastal region are working in Santa Barbara county. Deepest of the pair is Standard Oil Co.'s Orcutt area try, Rice Ranch No. 1 on section 14,9n-34w. This try is now drilling at 9120 ft. without having reported showings. The other, Tide Water Assoc. Oil Co.'s Davis No. 1, on sec. 33,8n-31w in the Los Olivos area, is preparing to run protective casing at 5055 ft. after reporting tar shows in the intervals 3717-3995 ft. and 4730-4856 ft.

Two Work at Gato Ridge

In the Gato Ridge field, sec. 4,8n-32w, two operators are under way. Currently turning to the right is O. C. Fields Texas Fee No. 1 which was last reported at 1910 ft. Preparing to start is a combination job between Barnsdall Oil Co. and Richfield Oil Corp. which proposes to drill No. 4 location on the Tognazzini property. The site is located 215 ft. south and 850 ft. east of corner No. 6 of the Rancho Los Alamos.

Alliance Finishes North Ventura Well

Alliance Pet. Corp. demonstrated the productivity of the northerly flank of the Ventura Avenue field at greater depth when it finished Hisey No. 5 at 10,575 ft. flowing 1375 bbls. of clean 32 gravity oil and 1,120,000 cu. ft. of gas through a 32/64 in. bean. Also at the north end, Lloyd Corp. is preparing to finish well No. 1 at 11,406 ft. after landing 5 in. liner on bottom and securing a shut off on a c.p. job at 10,730 ft.

In the westerly section of the field, where completions have also been good, Shell Oil Co., Inc. is drilling Nos. 146 and 155 on the Taylor lease and has graded for No. 156.

Buena Park Well Flows Through Tester

The Texas Co.'s Buena Park 4-E No. 1, sec. 36,3s-11w, is flowing through the tester from gun perforated intervals at 9300-9315 and 9335-9345 ft. With the packer set at 9180 ft. the well made 30 bbls. of 21.8 gravity oil in 5 hours with the cut ranging from 1 to 14%. At last report the well was flowing and swabbing a 130 bbl. daily rate. While not considered exactly commercial owing to its depth and recovery ratio, the

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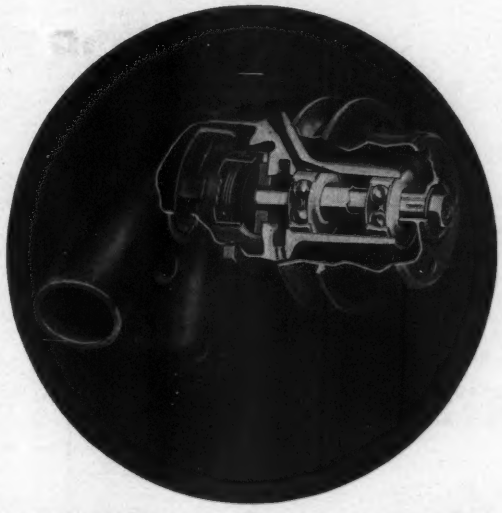

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well does serve as yet another indication that probably a field of major porportions exists nearby. The current try is Texaco's third in the immediate area. The first Spencer No. 1, produced similarly in the interval 8900 to 8932 ft., while the second, Buena Park No. 1, was abandoned without success at 9042 ft.

Petroleum Accountants Luncheon Meeting

The Petroleum Accountants Society held a luncheon meeting August 20. Lieutenant Commander Frank Higby, United States Coast Guard, Captain of the Port, Wilmington Operating Base, spoke on "Activities at Los Angeles Harbor", and answered questions following his address.

Paul Stanley, Barnsdall Oil Co., was chairman of the day. I. J. Hancock, Union Oil Co. of California, is president of the Society.

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